Diesel Power

& Diesel Transportation

Our 29th Year

AUGUST, 1951

ONLY WEAR

TEXACO

TEXACO

DIESEL POWER and DIESEL TRANSPORTATION for August, 1951, Vol. XXIX, No. 8. It is published monthly by Diesel Publications, Inc., Orange, Conn. Executive and Editorial offices at 192 Lexington Ave., New York 16, N. Y. Subscription rates: United States, $3.00 per year; single copies 35¢; Canada $4.00; Foreign $5.00 per year. Entered as second class matter April 29, 1949 at the Post Office, Orange, Connecticut, under Act of March 3, 1879.

3/10,000 INCH PER 1,000 HOURS OPERATION

Gas engines protected with TEXACO URSA OIL

This convincing evidence of outstanding performance—only .0003" wear of cylinder liners per 1,000 hours of operation—is reported of an Oklahoma company.* It applies not to just one, but to a large number of Clark RA 6- and 8-cylinder gas engines lubricated with *Texaco Ursa Oil.* Such performance is outstanding but not exceptional, because *Texaco Ursa Oils* give maximum protection against wear in all types of engines—Diesel, gas or dual-fuel—under all operating conditions.

Texaco Ursa Oils resist oxidation and stand up under heat and pressure. Rings stay free, ports stay open and valves active. This adds up to better compression and combustion . . . more power—lower fuel consumption and maintenance costs.

Available in every needed viscosity, *Texaco Ursa Oils* are approved by leading engine builders. These oils are easily America's favorite. In the Diesel field, for example:

More stationary Diesel h.p. in the U. S. is lubricated with Texaco Ursa Oils than with any other brand.

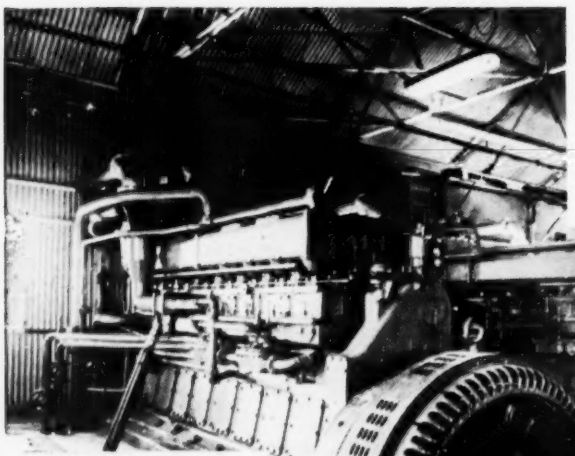
A Texaco Lubrication Engineer will gladly help you step up efficiency throughout your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

*Name on request

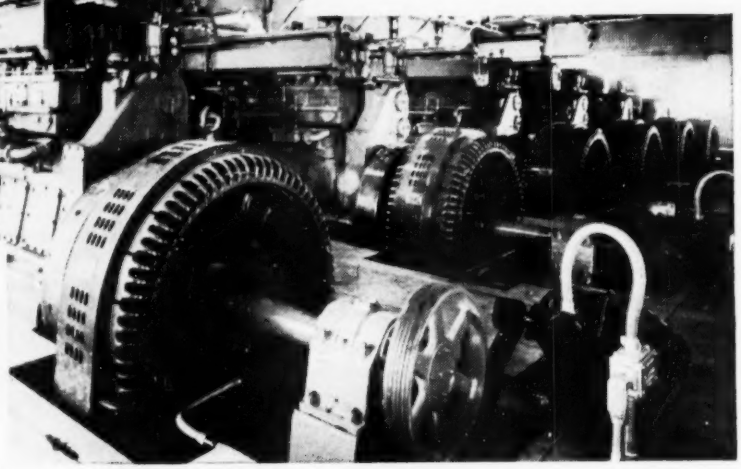
URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

PICKERING

Synonym for dependability since 1862



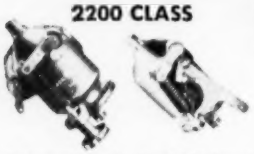
Generating station of a midwestern oil company showing a battery of generators on which Pickering Governors are an integral part.



PICKERING

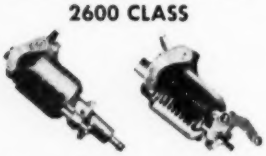
A Complete Line of
MECHANICAL AND HYDRAULIC GOVERNORS

2200 CLASS



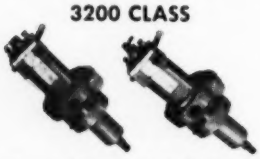
Constant Speed Variable Speed

2600 CLASS



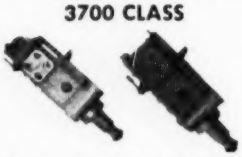
Constant Speed Variable Speed

3200 CLASS



Constant Speed Variable Speed

3700 CLASS



Constant Speed Variable Speed

For 89 years, Pickering Governors have met and anticipated the needs of American Industry. They have more than established a reputation for fully-dependable, long-term service under every type of operating condition.

Today, Pickering stands ready to supply the right governor for the job – to supply the governor that will maintain operating efficiency at its peak regardless of service conditions.

To consult Pickering Engineers may be your passport toward more efficient and economical operation of diesel equipment.

THE PICKERING GOVERNOR CO.

Established 1862

88 LLEWELLYN AVENUE · BLOOMFIELD, NEW JERSEY

7614

GM Diesels Cost Less to Maintain

"MAINTENANCE expense on our GM Diesels is lower than on other makes of power," states E. E. Coleman, manager, Bradley Mining Co. The Bradley fleet includes five Euclid trucks and four Koehring dumptors—*all GM Diesel-powered.*

GM Diesel's 2-cycle operation means less wear and tear on parts, longer engine life. Because power is delivered on every piston downstroke, pistons and other moving parts do not have to travel nearly as far to produce a given power output.

Two-cycle design also makes GM Diesels far more compact than other Diesels of equal horsepower. Parts are lighter weight and easier to get at. GM unit injectors eliminate troublesome high-pressure fuel lines and are individually replaceable.

One of a fleet of five GM Diesel-powered Euclids owned by Bradley Mining Co., Stibnite, Idaho, nation's largest producer of antimony ore.

Finally, all GM Series 71 engines have the same cylinder size, which means that most parts are interchangeable in any unit from 2 to 24 cylinders. Interchangeability of low-cost Factory-Engineered parts saves mechanics' time and reduces parts inventories. It cuts down service time—keeps GM Diesels on the job.

For full information on these hard-working, easy-to-maintain 2-cycle Diesels, consult your nearby GM Diesel distributor or write us direct.

ANSWER THE CALL CIVIL DEFENSE

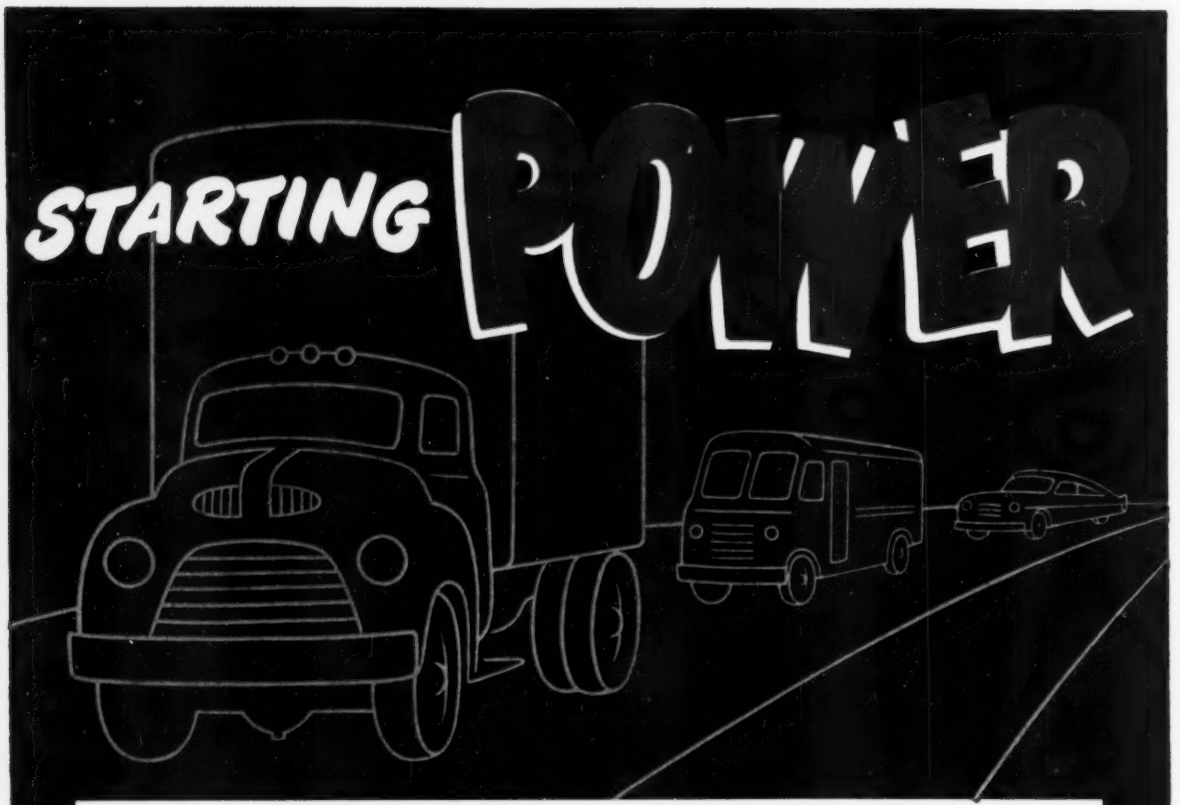
DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES... Up to 275 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS... Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK



Built specifically for the job
Exide Diesel Starting Batteries

You can always count on Exide Batteries for peak performance in diesel engine starting. That's because they're built specifically for the job . . . built to take the toughest cranking assignments. Back of them is a quarter-century of research-engineering devoted to diesel battery development, and to provide you with a battery that fully meets *ALL heavy-duty cranking needs . . . in all climates.* In Exide Diesel Starting Batteries, you get:

QUICK BREAKAWAY and fast acceleration of engine to firing speed.

LOW DEPRECIATION due to their extra long life.

LOW COSTS of operation, maintenance.

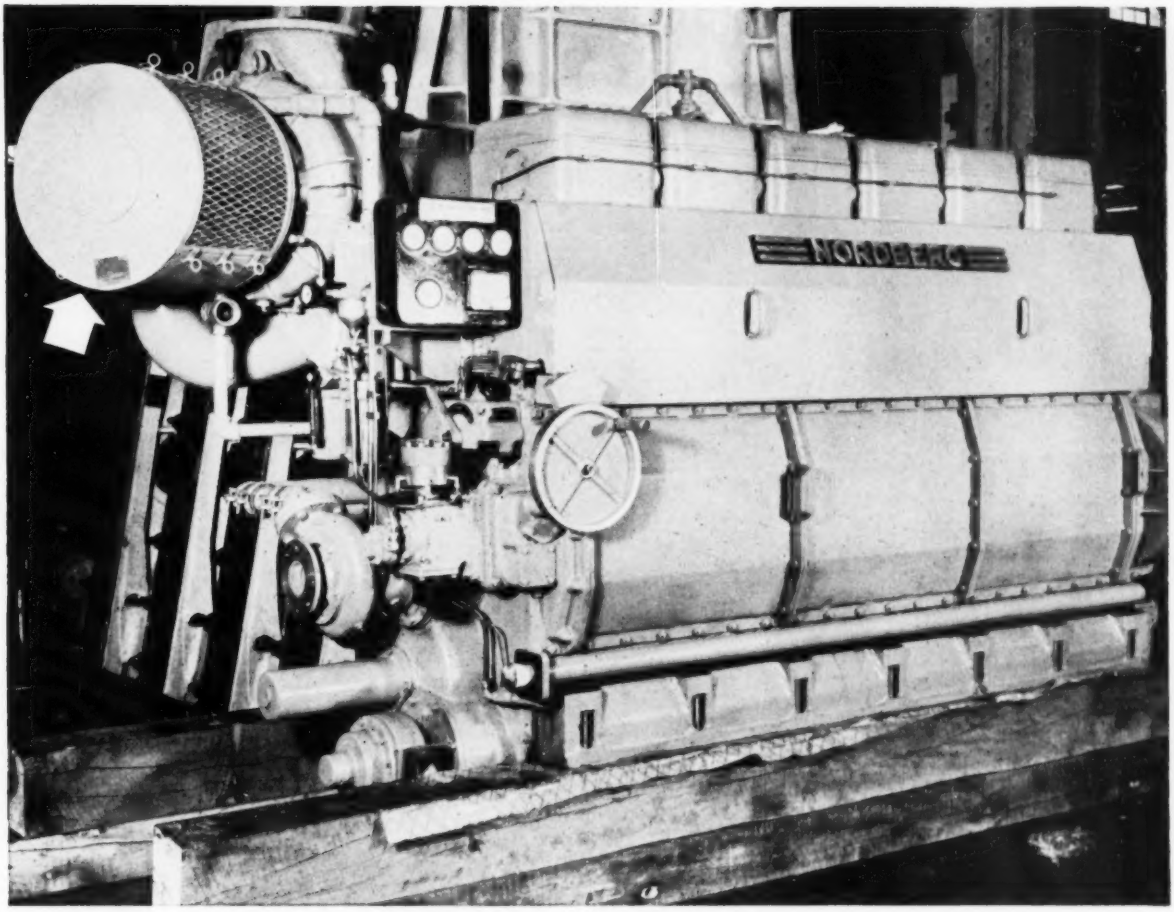
RUGGED CONSTRUCTION for rough usage in hard service.

Use Exide Diesel Starting Batteries for all heavy-duty service . . . in buses, trucks, tractors, off-the-highway equipment, ships, power plants, diesel-electric locomotives.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto
"Exide" *Reg. Trade-mark U.S. Pat. Off.*

WHEN IT'S AN EXIDE
YOUR DIESELS START

1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951



Nordberg cuts air intake noise with AIR-MAZE filter-silencer

This Nordberg six cylinder supercharged Duafuel Diesel is built for efficient power production. To assure a long, quiet life, it is equipped with an Air-Maze Type "E" filter-silencer. Mounted on the blower inlet casing flange, it overcomes annoying air noise with a specially designed acoustical chamber. A permanent, cleanable filtering element keeps dust and dirt out of the engine, greatly reduces wear and overhaul costs.

Air-Maze filter-silencers are available in a wide range of designs—including cylindrical design (above) as well as square types incorporating flat panel cells. Both curved and flat panels are of special construction to provide maximum efficiency over a wide range of air velocities. They are easily removed for servicing.

For help with your filter problems contact your nearby Air-Maze representative or write Air-Maze Corporation, Cleveland 5, Ohio.

The biggest names in diesels are protected by Air-Maze filters

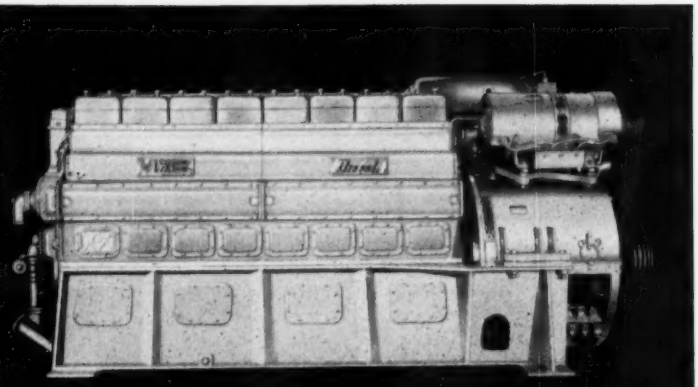
AIR FILTERS
SILENCERS
SPARK ARRESTERS

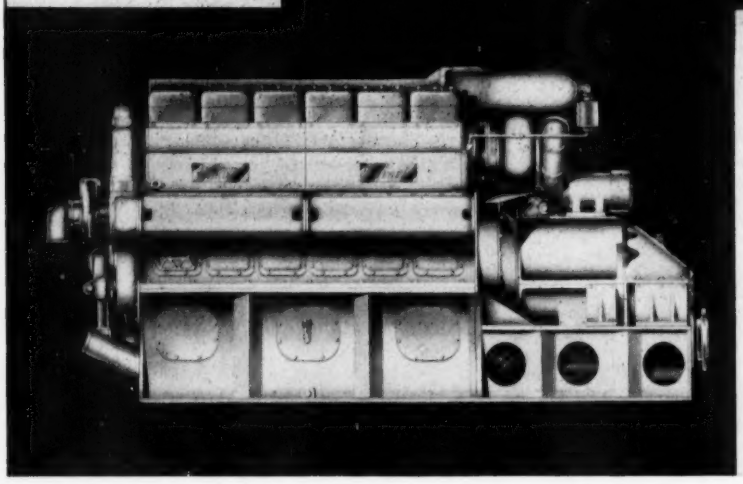
AIR-MAZE
THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

50 YEARS

OF EXPERIENCE AND PROGRESS





ABOVE

Sterling Viking Diesel 8 cylinder generator set rated at 600 KW.

LEFT

Sterling Viking Diesel 6 cylinder marine engine with reverse gear, rated at 665 HP in continuous service.

●

Descriptive bulletins on these and other Sterling Viking Diesel engines from 150 to 1000 BHP will be sent on request.

POWER to move ships and trains, to operate machinery or to light airports, means much more than merely installing an engine.

Fifty years of experience...broad and successful experience in applying power to just about every conceivable use is one of the reasons why Sterling engines are held in such high regard the world over.

Engineering progress is a second reason for Sterling preference. The best evidence of what constitutes success in engine design and performance is when customers come back for more.

We have the present day orders, facts and figures to show every marine and industrial user of power that Sterling's first 50 years marks just the beginning. *Talk to a Sterling Engineer.*

Sterling

MARINE AND INDUSTRIAL

ENGINES

● Depend upon Sterling Diesel Power for Locomotives, Generator Sets, Commercial and Fishing Craft, Lift Bridges, Ventilating Systems, Drilling Rigs, Etc.

STERLING ENGINE COMPANY • 1270 Niagara Street • Telephone Lincoln 0382 • Buffalo 13, New York

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT	RPM Delo R.R. Oil
UNIT	Locomotive diesel engines
SERVICE	Freight and passenger
OPERATION	Local and transcontinental
MAINTENANCE	Progressive

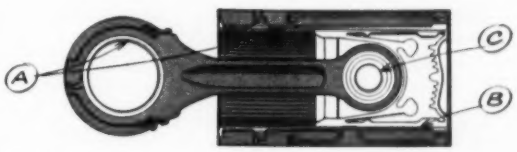
One million miles of service from engine parts!

LUBRICATED WITH RPM DELO R.R. OIL, many diesel engines in the locomotives of U.S. railroads have been in service for long periods without complete overhaul! Many of the liners, pistons, bushings and other parts in these engines have now been in use for hundreds of thousands of miles. Progressive maintenance inspections indicate that RPM DELO R.R. Oil will keep the parts in service for at least one million miles, the general overhaul period set by some of the railroads.

RPM DELO R.R. Oil keeps parts clean and free of wear-causing lacquer and gum deposits and is not corrosive to engine metals of any kind.

IN OVERLAND MOUNTAINOUS FREIGHT SERVICE for nearly 500,000 miles, this liner, lubricated with RPM DELO R.R. Oil has less than 0.006 inch wear and taper is so minor that it is barely measurable.

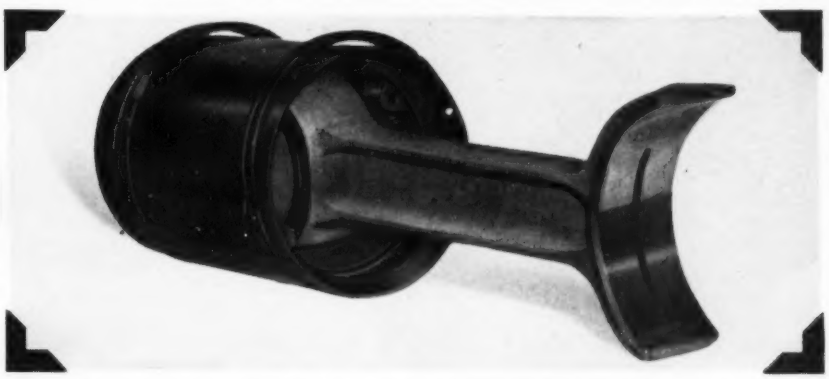
How RPM DELO R.R. Oil prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushing or bearing metals and foaming in crankcase.



THIS PISTON AND CONNECTING ROD have been in service for more than four years. After picture was taken it was put back in the engine for further use. Note the excellent condition of the rings and bearing. All the rings are free, oil holes open and there are no troublesome deposits in any ring grooves.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any one of the companies listed below.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

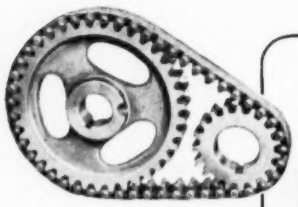
THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

Automatic joint snugness . . . anti-back-bend . . . anti-whip . . .

YOU GET THEM ALL

. . . with the world's finest timing chain from the world's largest chain plant



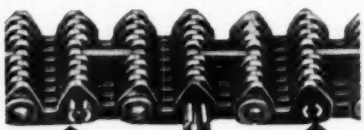
Today every designer is on the spot. More than ever, he has to be sure he's getting the best components for his engine. And he also has to be sure the source is dependable.

That's why Link-Belt Timing Chains and Sprockets are your best bet. It's the highest load-carrying chain on the market. Yet designs for some leading manufacturers measure only $1\frac{1}{16}$ inches in width! This narrower design will save valuable space in your engine.

More—the tremendous facilities of the new Link-Belt plant are your assurance of a continuing supply. Here high-level research is constantly in progress . . . to keep you out in front with the latest technical developments.

Let our engineers cooperate in the proving of your latest engine. We will gladly supply a test drive to your specifications. Details are in engineering catalog No. 2065.

WHY SEGMENTAL BUSHINGS MEAN BETTER PERFORMANCE FOR YOUR ENGINE



Removable case-hardened segmental liners or bushings extend across entire chain width—double bearing surface . . . halve bearing pressure on joint

Broached holes in links form lock grip for bushings

Smooth, case-hardened pin, free to rotate between segmental bushings, presents every part of surface for wear

Bushing takes wear at joint—elongation of link hole or eye is negligible

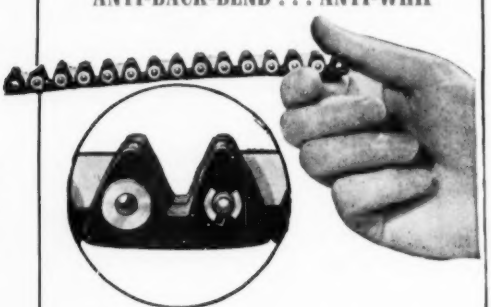
AUTOMATIC JOINT SNUGNESS

Segmental bushings are made with slight bow

After initial assembly in chain, bushings are straight

Bow in bushing acts to keep a snug joint, maintaining chain pitch

ANTI-BACK-BEND . . . ANTI-WHIP



Built-in check in joint limits bushing rotation, checks back-bend and whip

Great flexibility of Link-Belt Duplex Timing Chain is exploited for timing and fuel pump drive on this engine. Either face of the chain meshes with wheels.

12,380

LINK-BELT

TIMING CHAINS AND SPROCKETS

LINK-BELT COMPANY: 220 South Belmont, Indianapolis 6, Ind. Offices in principal cities.

Building the 2nd ten thousand on the experience of the 1st

IN June of this year Electro-Motive Division celebrated the completion of the ten thousandth General Motors Diesel locomotive unit.

This record of production is a landmark in national progress because of the improvements in transportation this motive power has made possible.

But still more important, the skills, the facilities and the experience gained in producing ten thousand Diesel locomotive units stand for a promise of even greater things to come.

For we view this outstanding record, made with the cooperation of American railroads, as a new base line of our responsibility to the men charged with continued improvement of railroad transportation.

We believe that the confidence placed in us by the railroads, through their purchases of General Motors locomotives, imposes upon us the responsibility to keep these skills, experience and facilities at work in constant improvement of locomotive design and manufacturing techniques.

As we enter upon production of the Second Ten Thousand, we intend to build upon the experience of the past with developments, refinements and improvements which should add even more efficiencies and economies to one of the most vital and fascinating industries in the world.

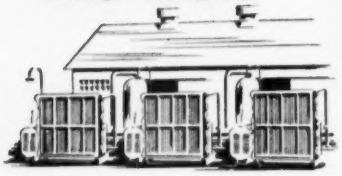
ELECTRO-MOTIVE DIVISION

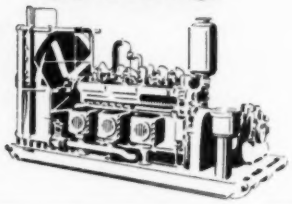
GENERAL MOTORS GENERAL MOTORS LOCOMOTIVES LA GRANGE, ILL.

Home of the Diesel Locomotive

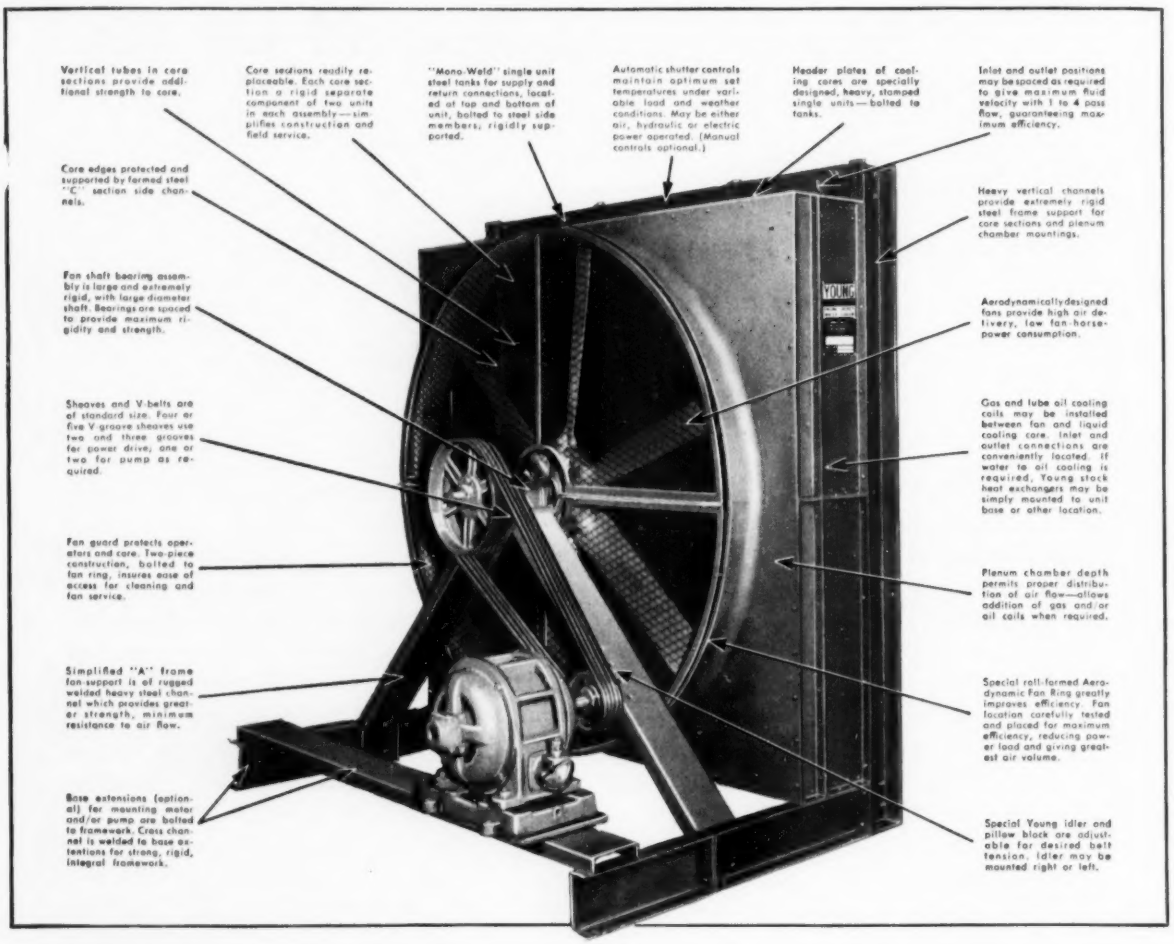
In Canada: GENERAL MOTORS DIESEL, LTD. London, Ontario

Presenting the New YOUNG Jacket Water Coolers





Greater cooling capacity...more compact, rugged design for stationary or portable Diesel engine applications


Vertical tubes in core sections provide additional strength to core.
Core sections readily replaceable. Each core section a rigid separate component of two units in each assembly—simplifies construction and field service.
"Mono-Weld" single unit steel tanks for supply and return connections, located at top and bottom of unit, bolted to steel side members, rigidly supported.
Automatic shutter controls maintain optimum set temperatures under variable load and weather conditions. May be either air, hydraulic or electric power operated. (Manual controls optional.)
Header plates of cooling cores are specially designed, heavy, stamped single units—bolted to tanks.
Inlet and outlet positions may be spaced as required to give maximum fluid velocity with 1 to 4 pass flow, guaranteeing maximum efficiency.
Core edges protected and supported by formed steel "C" section side channels.
Heavy vertical channels provide extremely rigid steel frame support for core sections and plenum chamber mountings.
Fan shaft bearing assembly is large and extremely rigid, with large diameter shaft. Bearings are spaced to provide maximum rigidity and strength.
Aerodynamically designed fans provide high air delivery, low fan-horsepower consumption.
Sheaves and V-belts are of standard size. Four or five V-groove sheaves use two and three grooves for power drive; one or two for pump as required.
Gas and lube oil cooling coils may be installed between fan and liquid cooling core. Inlet and outlet connections are conveniently located. If water to oil cooling is required, Young stock heat exchangers may be simply mounted to unit base or other location.
Fan guard protects operators and core. Two-piece construction, bolted to fan ring, insures ease of access for cleaning and fan service.
Plenum chamber depth permits proper distribution of air flow—allows addition of gas and/or oil coils when required.
Simplified "A" frame fan-support is of rugged welded heavy steel channel which provides greater strength, minimum resistance to air flow.
Special roll-formed Aerodynamic Fan Ring greatly improves efficiency. Fan location carefully tested and placed for maximum efficiency, reducing power load and giving greatest air volume.
Base extensions (optional) for mounting motor and/or pump are bolted to framework. Cross channel is welded to base extentions for strong, rigid, integral framework.
Special Young idler and pillow block are adjustable for desired belt tension. Idler may be mounted right or left.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality — T. M. Reg. U.S. Pat. Off.

Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY

Dept. 411-H • RACINE, WISCONSIN

Factories at Racine, Wisconsin, and Mattoon, Illinois

OIL FIELD DISTRIBUTORS:

TULSA: J. R. Meek Company, 1341 S. Boston St., Rm. 109

LOS ANGELES: Flournoy & Everett Inc., 5043 Santa Fe Ave.

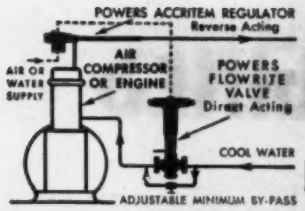
MUSKEGON: Harold J. Young, 206 Montgomery Bldg.

Others In Principal Cities

From the many features shown above, you can see that *extra ruggedness* is built into every component of improved Young Jacket Water Coolers. The result is a unit that will last the life of the power plant . . . one that excels in mobile service—that has the necessary compactness and ample capacity for field duty on portable equipment.

Young designing permits the addition of lube oil and/or gas cooling coils between the water cooling core and the fan, making possible a lower fan-horsepower requirement.

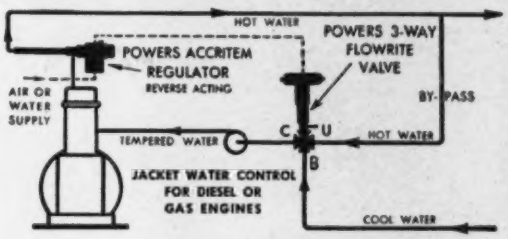
Catalog No. 1351 plus ratings, specifications and other details will be furnished upon request. See your nearest Young Distributor, or write direct.



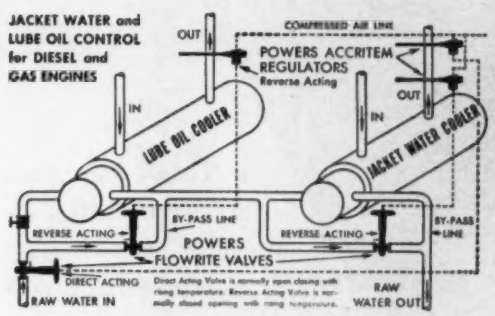
POWERS

ACCRITEM REGULATOR

Unsurpassed for reliability and power to operate large or small size 3-way or 2-way diaphragm valves for accurate control of jacket water and lube oil cooling temperatures.



Only a few of many applications are shown here.



Gives

Accurate, Low Cost Heat Control

Use Accritem Regulators to control diaphragm operated valves or dampers. They save labor, stop losses caused by over-heating and have the following —

IMPORTANT ADVANTAGES

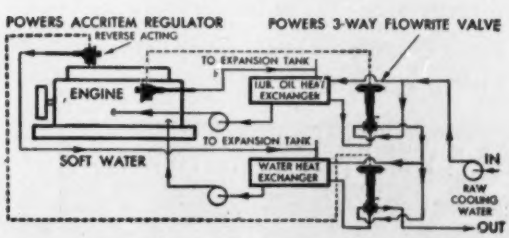
- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures many years of reliable service.
- ***Temperature Ranges*** 50 to 250° F. and 150 to 350° F.
- ***Easy to Install*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size***—regulator head is only 2⅞" x 3⅝", sensitive bulb is 12" long with ½" I.P.S. connection.

Proper Cooling Temperatures assured by Powers Accritem Regulators

• Makes ignition easier • Prevents rapid breakdown of lube oil • Decreases cylinder and piston ring wear • Reduces danger of piston seizure • Lowers fuel and lube oil consumption

POWERS

FLOWRITE and METAFLOW Diaphragm Valves controlled by a POWERS ACCRITEM HEAT REGULATOR provide an unbeatable combination for *better control and lower maintenance*



Write for Bulletin 316—or phone our nearest office for prices and further information about POWERS ACCRITEM regulators and diaphragm valves.

THE POWERS REGULATOR CO.

OFFICES IN OVER 50 CITIES • See Your Phone Book

CHICAGO 14, ILL., 2720 Greenview Ave. • NEW YORK 17, N.Y., 231 E. 46th St.
LOS ANGELES 5, CAL., 1808 West 8th St. • TORONTO, ONT., 195 Spadina Ave.
MEXICO, D. F., Apartado 63 Bis.

AMD

60 Years of Temperature and Humidity Control

P&H DIESEL ENGINES

2-CYCLE

Almost any part FITS THEM ALL!

• Think how that cuts your costs . . . simplifies parts stocking . . . speeds up service. 80% of *all* parts fit *all* P&H Diesels—1, 2, 3, 4, and 6-cylinder models. For example, the standard cylinder and liner assembly can be replaced in *any* P&H Diesel in only 40 minutes. You don't even drop the pan. Greater interchangeability is one more reason you should standardize on P&H Diesels. Available in bare engines, power units and generator sets. Write for literature, Diesel Division, Harnischfeger Corporation, Port Washington, Wisconsin.

P&H DIESEL DIVISION
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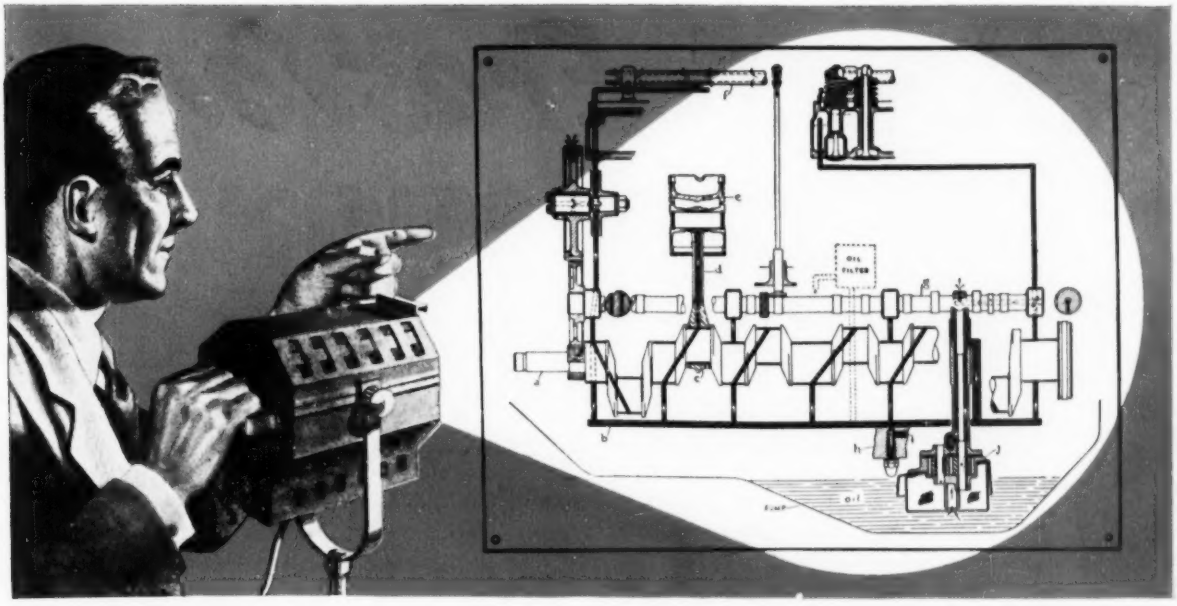

Man with a new light on your DIESEL LUBRICATION

EVEN THE NORMAL EFFECTS from compression, combustion and load make it tough enough for any Diesel engine oil. Yet in addition you want to be sure your Diesel oil will be master of special needs —sometimes imposed by particular mechanical conditions . . . or by fuel characteristics, load or even by factors of climate and altitude.

You'll get a new light on this whole range of lubrication complexities, as it affects your own Diesels, by calling in a Cities Service Diesel Lubrication engineer. He is qualified to tailor a Diesel lubrication program that will contribute to maximum hourly output and sharply lower costs. Like scores of other Diesel operators throughout industry you can profit by drawing on the knowledge and experience of a Cities Service Diesel specialist. Contact the office nearest you, or return the coupon below. It brings details—plus a valuable Diesel booklet, free.

The Cities Service complete line of top quality petroleum products includes a Diesel lubricant for every operating condition.

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CITIES SERVICE OIL COMPANY
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Please send me without obligation your booklet on Diesel Engine Lubrication.

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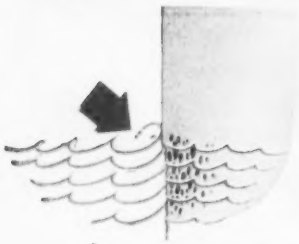
Beat Erosion...



GUN IRON CAST PARTS

The proof of Gun Iron's erosion resistance has come from a wide variety of applications. One typical example is the case of cylinder liners for diesel engines. Chemical impurities in the water used for coolant cavitate ordinary liners to the point where they are useless long before worn out. Gun Iron liners satisfactorily withstand erosion and at the same time give longer wear on the cylinder wall. Users report tremendous savings in maintenance and replacement costs.

If *your* cast parts are subjected to frictional wear, heat, pressure or erosion, it will pay you to investigate Gun Iron. Our engineers are ready to assist you in determining its value. **HUNT-SPILLER MANUFACTURING CORP., 373 Dorchester Ave., Boston 27, Mass.**

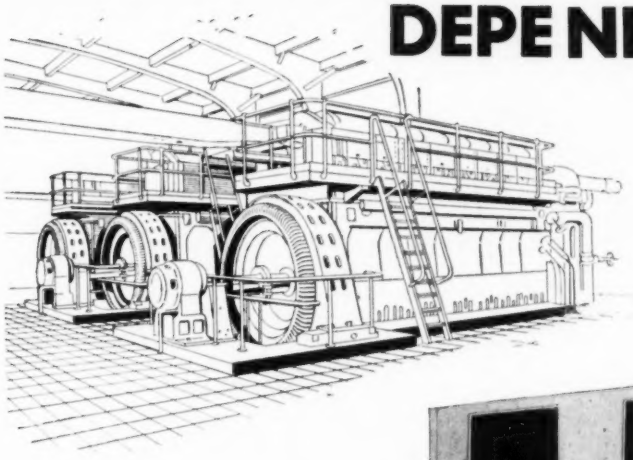
Canadian Representatives: Jos. Robb & Co., Ltd., 4050 Namur St., Montreal 16, P.Q.

***HERE IS A PRACTICAL GUIDE** for the user of iron and steel castings . . . 24 pages of technical data on many types of metals and alloys. Write for your free copy.*

FINE DIESELS REQUIRE DEPENDABLE COOLING

by

"Buffalo"



"Buffalo"

EVAPORATIVE COOLERS

Many of the country's top-ranking Diesels are cooled by "Buffalo" Evaporate Coolers—because these units keep water jacket temperatures to within a very few degrees of the setting, through long runs and fluctuating loads. "Buffalo" Coolers require minimum space, use little spray water and are easy to operate. And quality "Buffalo" construction, Pumps and Spray Nozzles and Aerofin Coils are standard equipment—tops in the business. WRITE FOR BULLETIN 3666 and have a "Buffalo" engineer show you how "Buffalo" Coolers can give your Diesels the temperature protection they require.

"Buffalo" FIRST FOR FANS

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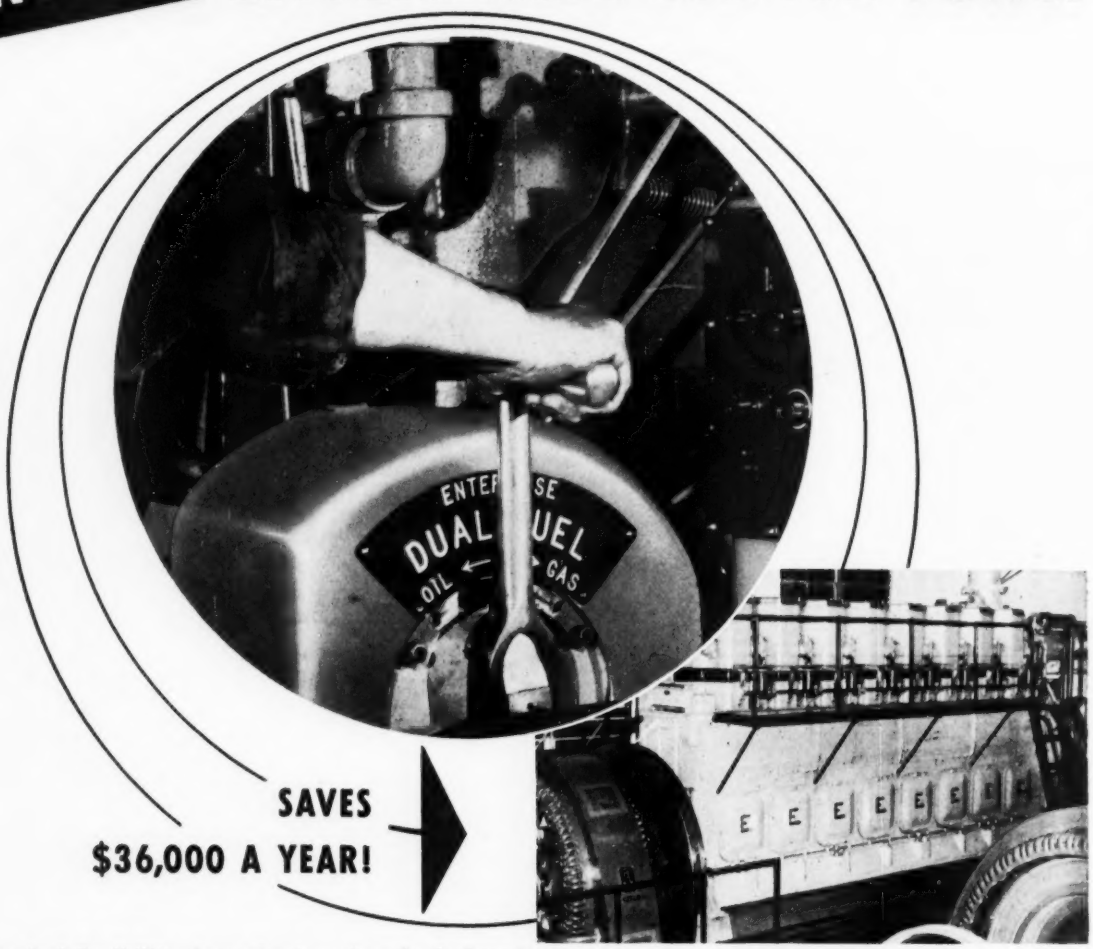
140 MORTIMER ST. BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Branch offices in all Principal Cities

EVAPORATIVE COOLERS AND AXIAL FLOW FANS FOR COOLING MOBILE AND STATIONARY DIESELS

PROVED ENTERPRISE *Dual Fuel* Power



Two Enterprise Dual Fuel Units are now in service at the Municipal Utilities plant in Broken Bow, Nebraska. Their combined capacities of 1800 KW more than doubles the capacity of the three straight diesels formerly in operation—*at an estimated saving of $36,000 per year in fuel costs alone!*

Selective fuel flexibility, important savings in fuel costs dependable service and operation using various grades of inexpensive fuels—these are the basic reasons why more and more cities and towns, co-ops and industrial plants are installing dual fuel engines. Modern Enterprise Dual Fuel Engines combine all these advantages to provide highest engine efficiency at lowest power cost through three-way fuel flexibility:

1. **Handles any combination of gas and oil,** from full diesel to about 94% gas, 6% pilot oil. Changeover from one fuel to the other is smooth, positive and instantaneous through simplified controls.

2. **Burns diesel, crude and residual fuels.** Many grades of properly prepared crude and residual fuels can be used.

3. **A wide variety of gas fuels are suitable,** including natural gas, butane or butane-propane mixture—whichever is available at lowest cost.

Get full details on quality-built, cost-saving Enterprise Dual Fuel engines today. Models from 250 to 1755 BHP per unit, generator sets to 1250 KW, turbocharged or normally aspirated. Bulletin No. DF-200 will be sent you on request.

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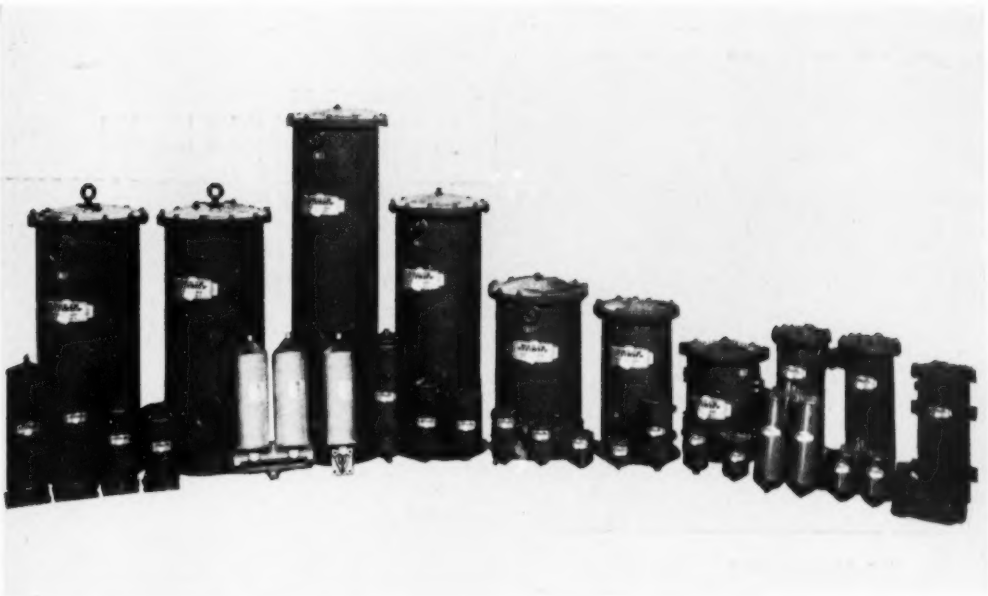
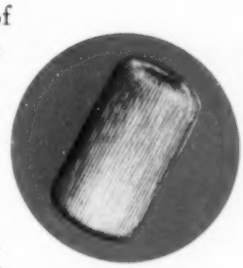


WINSLOW has the *RIGHT FILTER* for YOUR ENGINE

You know from your own experience that the amount of fuel or lubricating oil used by one engine—and the rate at which it flows—is probably not the same as in another engine of a different size or power rating. Thus, when you want to protect your fuels and lubricants from dirt, you must have *the right size filter for your engine.* Winslow not only makes a filter of the size you need, but Winslow engineers are ready and willing to recommend that right size filter from the more than 100 models made by this pioneer manufacturer.



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WINSLOW FILTERS

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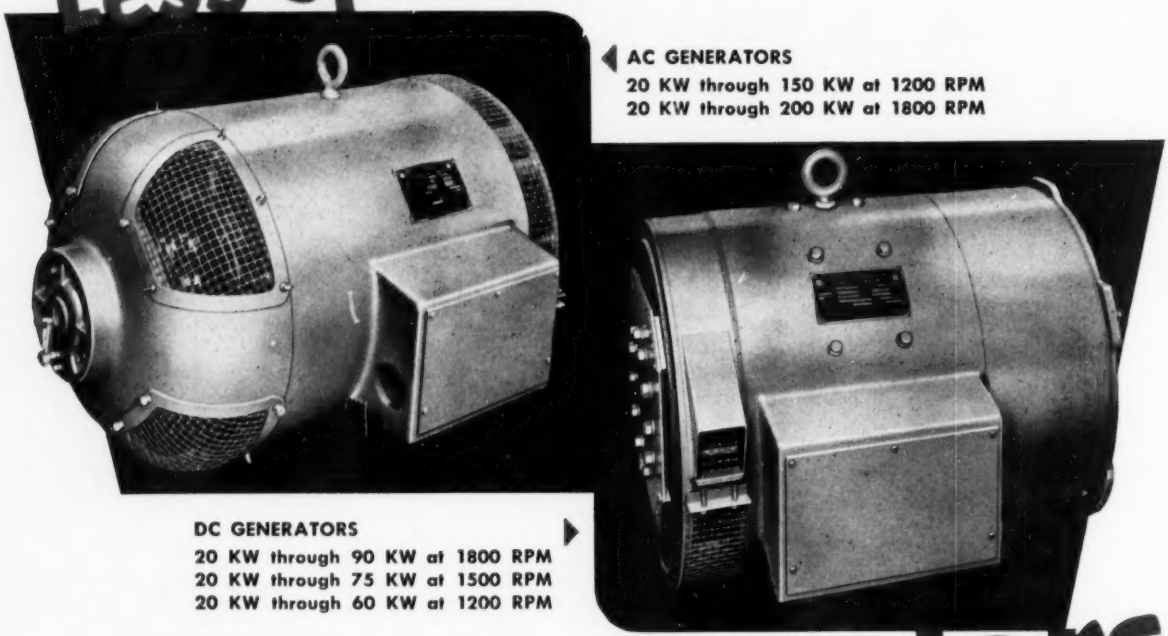
Less upkeep · Longer life



AC GENERATORS
20 KW through 150 KW at 1200 RPM
20 KW through 200 KW at 1800 RPM

DC GENERATORS
20 KW through 90 KW at 1800 RPM
20 KW through 75 KW at 1500 RPM
20 KW through 60 KW at 1200 RPM

Delco Generators

Next to dependability, longer life is the chief consideration in the selection of an efficient electric power source. That's why Delco generators rate high with engine manufacturers and assemblers the country over. For Delco delivers . . . gives you low annual costs . . . performance and efficiency, hand-in-hand.

The features of the Delco generator design pay off in advantages of size, weight and compactness. And many features of construction and items of equipment which might normally be classed as *extras*, remain standard with Delco.

Power range of Delco generators for engine-driven stand-by and portable equipment is from 20 through 200 KW.—AC and DC—1200, 1500 and 1800 RPM. Any of the sales offices listed below will be glad to supply detailed information.

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DELCO GENERATORS

DELCO PRODUCTS, Division of General Motors Corporation, Dayton, Ohio

SALES OFFICES: Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis

American **Flexible** Metal Hose

for exhaust and air intake

Absorbs Vibration
American Flexible Metal Hose effectively absorbs engine and exhaust vibration which would otherwise be transmitted along the line.
Simplifies Offsets
The flexibility of American Metal Hose cuts installation time and effort. It's especially adapted to offset connections where it can be bent to take care of misaligned ports.
Eliminates Expansion Stresses
Severe thermal expansion and contraction stresses are taken in stride by American Flexible Metal Hose. This self-adjusting flexible hose moves with such disturbances, keeps them within its own length and thus prevents shearing of flange bolts, etc.

two general types available

American Flexible Metal Hose for exhaust or air intake—marine or industrial diesels — is available in two general types: Corrugated Steel, Type B, illustrated at left; and Interlocked Steel, shown at extreme right. Flanges are available to ASA standards or various navy specifications. For details, write The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd. 5122A

Other Products For Diesel Use

Flexible tubing with wire braid covering for: starting air, circulating water, fuel oil, lubricating oil. Tubing available in bronze or carbon steel. Assemblies complete with fittings.

wherever connectors must move...

ANACONDA

American **FLEXIBLE METAL HOSE AND TUBING**

KOPPERS K-Spun POROUS CHROME RINGS double mileage of railroad diesels . . . cut cylinder wear in half . . . slash maintenance costs

Koppers K-Spun Piston Rings, produced by centrifugal casting process, are *100% stronger . . . four times more resistant to combustion shock than ordinary rings! They will not break in installation or for the life of the engine.*

Koppers Porous Chrome* Rings have a porous chrome surface that holds and distributes oil during break-in, quickly wears down to perfectly seated solid chrome that prevents grit and other particles from embedding in the ring surface where they can scratch cylinder walls. Porous Chrome Rings last up to four times as long as other rings, reduce cylinder wear 50% or more.

That's why railroads everywhere are reporting amazing savings in equipment and maintenance costs through the use of Koppers Rings. Remember . . . we make rings for any equipment that uses piston rings.

*VAN DER HORST PROCESS

If you have a piston ring problem, why not get the *right* answer from us? Write, wire or phone Koppers Co., Inc., Piston Ring Dept., 1548 Hamburg St., Baltimore 3, Md.

KOPPERS

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PISTON RINGS

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ONLY KOPPERS CAN FURNISH K-SPUN OR POROUS CHROME!

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Here is a practical cooperative plan that can help you cut controllable costs and offset higher non-controllables. From this single source you can get effective assistance on any problem that involves a petroleum product—any type of petroleum product.

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diesel operator saves approx.

$11,950 *a year on fuel costs*

By using one Sharples Centrifuge to purify low cost residual fuels to diesel engine requirements, diesel owners on land and sea are regularly reporting savings of thousands of dollars yearly on diesel fuel costs—without any sacrifice of engine efficiency.

Silica, carbon, metallic oxides, tank scale, and the other solid impurities which are present in Bunker C and residual fuels cause cratering on the injection nozzles. This cratering affects the atomization pattern of the fuel and results in incomplete combustion. The harmful solids are removed in one continuous operation—by the Sharples purifier.

Engines using this non-cratering fuel perform just as well as with more costly light diesel fuels. The Sharples Oil purifier itself requires minimum attendance or maintenance; it is automatic, operates 24 hours a day, and cleaning is a simple, 15-minute job.

With purification of residual oils thus reduced to a simple practical process by the Sharples Purifier, more and more diesel owners are taking advantage of the economies it affords, and savings in fuel costs alone quickly pay for the installation.

THESE ARE NOT CLAIMS—THEY ARE FACTS proved by the operating records of users of Sharples Continuous Oil Purifiers on diesel engines on land and afloat . . . it will pay you to investigate.

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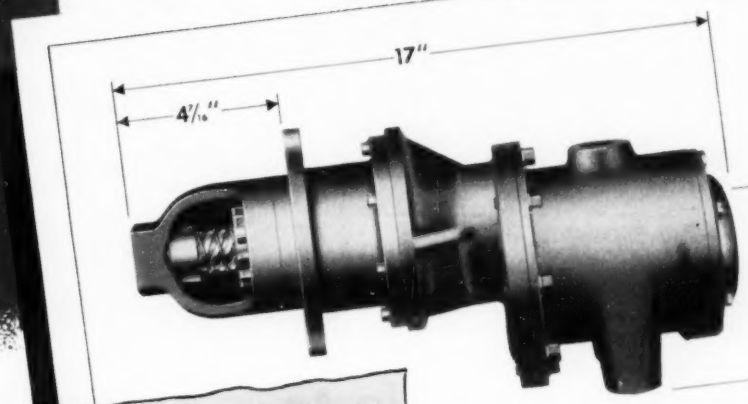
NEW AIR CRANKING MOTOR
Eliminates Batteries



INGERSOLL-RAND ANNOUNCES A COMPLETE LINE OF NEW AIR CRANKING MOTORS FOR ENGINE STARTING SERVICE.

Reliable and economical engine starting is now *yours* with powerful I-R Air Cranking Motors. Easy to install, these compact motors eliminate the need of generators, electrical controls and banks of storage batteries. Nine standard sizes, designed for use on over 150 commercial engines up to 3520 cubic inch displacement, are available to meet your individual requirements.

A powerful Multi-Vane air motor starts the engine through a standard Bendix drive, that matches the performance characteristics of the air motor. Air Cranking Motors cannot be burned out, or damaged by stalling. Their use also eliminates expensive repairs frequently caused by climatic conditions that deteriorate the insulation on electric motors. In many instances the yearly replacement cost of storage batteries pays the initial cost of an Air Cranking Motor.

In an emergency, a small bottle of compressed air or carbon dioxide piped into the motor may be used for starting purposes.

I-R Air Cranking Motors may be readily installed on your present engine by your own mechanics or your engine distributor. In mounting, the Bendix housing can be rotated on the gear case, and the gear case rotated on the motor housing to clear projections on the engine. Any mechanic familiar with maintenance of internal combusion engines can readily service an I-R Cranking Motor.

Fill out the coupon and mail it today for complete information on remarkable new trouble-free, low-cost, engine starting.

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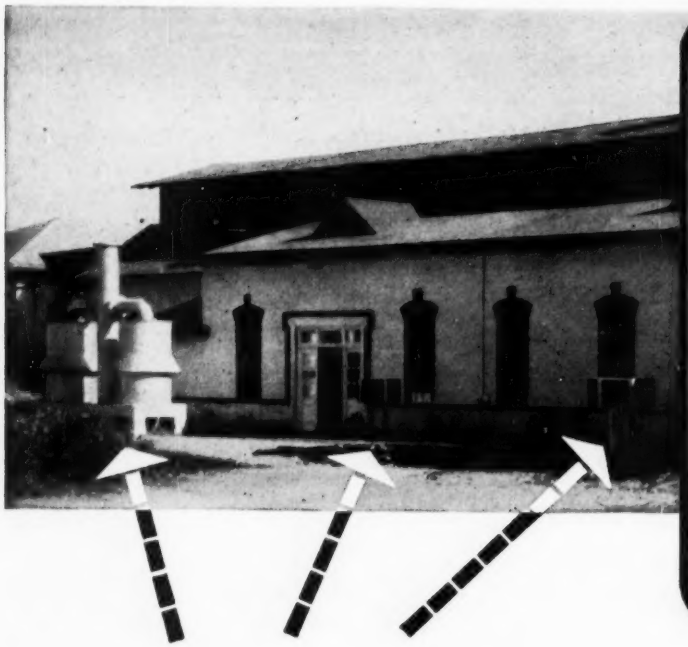
Please send me complete details of your new Air Cranking Motors.

Name _____ ☐ Engine Distributor

Address _____ ☐ Engine User

Make of engine _____ Model _____ Cu. in. of displacement _____



CLEAN AIR HELPS PAY for 400-Acre PARK

AAF Filters Contribute to High Profit Operation of Kansas Power Plant

The municipal power plant of Garnett, Kan., serves a community of only 2500 people, yet it netted a profit of $141,962.00 from 1945 through 1949. A portion of these earnings were used to develop a 400-acre park complete with swimming pool, golf course, football field and stadium.

The secret of this success story—low maintenance costs in which filtered air played an important role. Three of the four diesel engines are equipped with AAF Type "OC-H" washable, unit-type filters—the fourth and newest engine with a duplex Cycoil Oil Bath Air Cleaner. The oldest engine dating back to 1925 was only recently rebuilt and is now operating 2000 hours yearly. Another engine installed in 1930 has run more than 70,000 hours and still retains its original pistons and cylinder liners.

Here's convincing proof that clean air can pay a handsome profit—of AAF filters' ability to deliver continuous high-efficiency cleaning service. There's an AAF filter of a type and capacity designed to convert your dust into dollars. Write today for complete product literature.

AAF

American Air Filter

COMPANY, INC.

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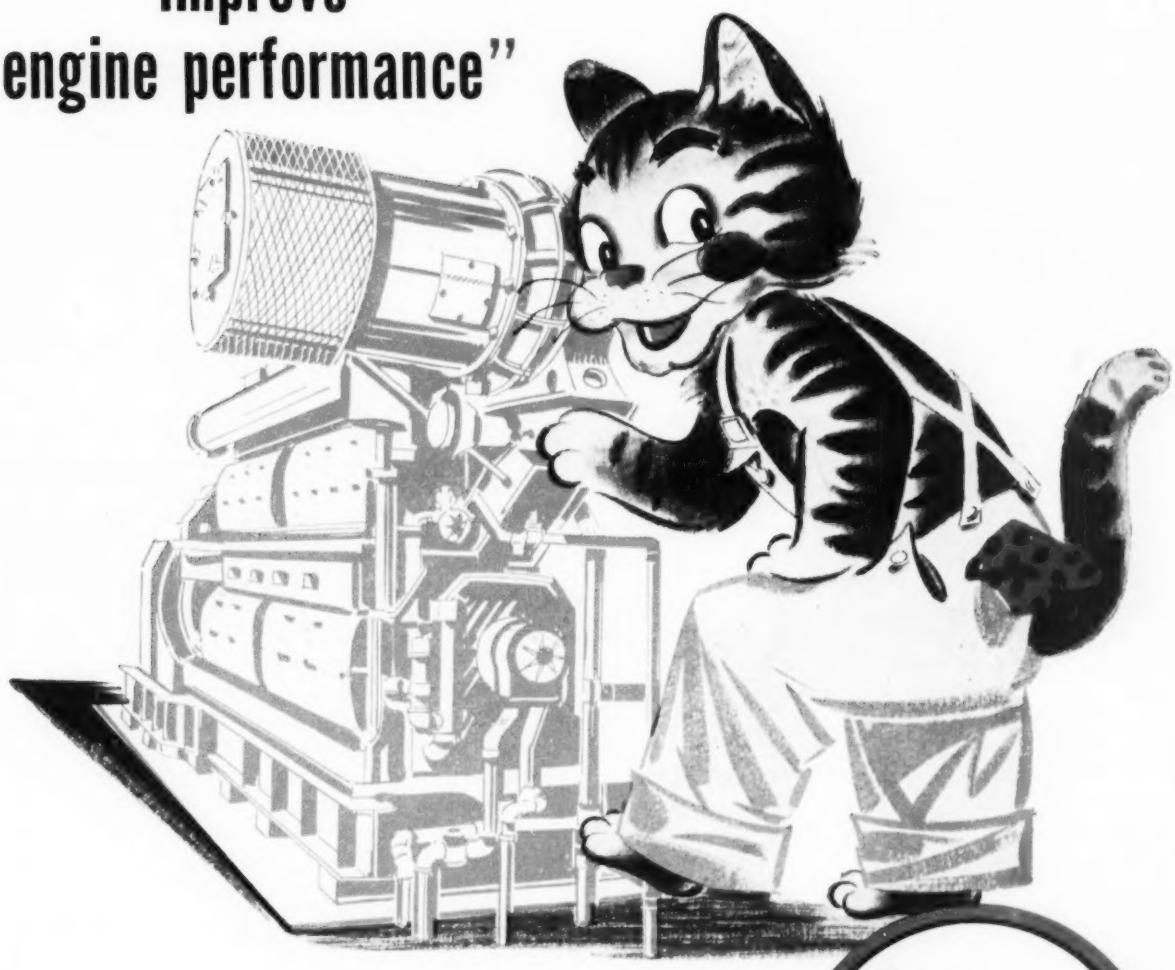
"Tycol Diesel Oils assure free rings improve engine performance"



Certainly! Tycol Diesel Lubricants resist sludging, gumming and carbonization. They are made from specially refined, high quality bases, and offer outstanding stability. They have high resistance to heat and decomposition. They help diesels operate continuously . . . with maximum efficiency . . . and lowest maintenance costs.

There is a Tycol Diesel Oil scientifically engineered for every Diesel application – from high-speed units for industrial, railway and marine uses where a heavy-duty or detergent oil is necessary to low speed Diesels where a non-additive lubricant can be used.

Want to learn more about these fine oils – engineered to do the job better, at lower cost? Call or write your nearest Tide Water Associated office today.

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"... and the purchase of U. S. Savings Bonds through the Payroll Savings Plan is an easy way to save. It is good for the community. It is good for you because it means money available for a rainy day. Through the thousands of years that men have roamed the globe there have always been rainy days."

A vigorous exponent of thrift, Captain Eddie Rickenbacker made the Payroll Savings Plan available to his employees of Eastern Air Lines some years ago. From time to time, in personally dictated letters addressed "To All Members of Eastern Air Lines Family", he points out the individual and national advantages of the Payroll Savings Plan, and urges members of Eastern Air Lines Family "... to sign up on the Automatic Payroll Savings Plan. In years to come I am sure you will be mighty glad you did."

How about *your* Payroll Savings Plan? What have you done since Savings Bonds became Defense Bonds? What is your percentage of employee participation?

From coast to coast, companies large and small are installing the Payroll Savings Plan or revitalizing their present plans through person-to-person canvasses which put a Payroll Savings Application Blank in the hands of every employee.

Note the results of some recent person-to-person canvasses. Think what management efforts like this mean to the Defense effort. Then phone, wire or write to Savings Bond Division, U. S. Treasury Department, Suite 700 Washington Building, Washington, D. C. Your State Director will be glad to help you put in a Payroll Plan or show you how to conduct a person-to-person canvass.

Results of recent person-to-person canvasses to increase participation in Payroll Savings

39 companies . . . total employees	487,347*
Employees on plan before canvass	81,481
Employees on plan after canvass	329,942
% of participation before canvass	16.8%
% of participation after canvass	67.7%
New savers added to plan	**248,461**

Based on National averages, employees in this group of companies are saving more than $7,000,000 every month in United States Defense Bonds.

**Includes 62,070 employees of six companies which did not have plan before canvass.*

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

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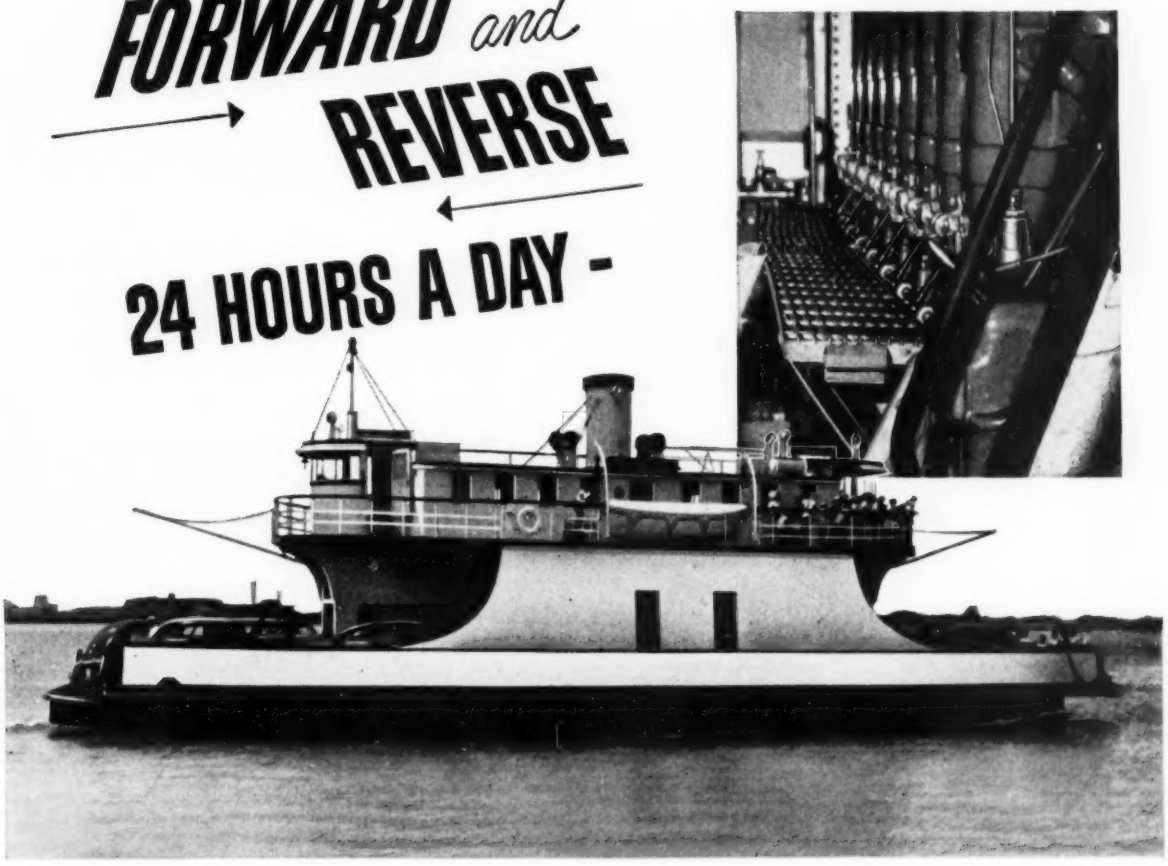
FORWARD and REVERSE

24 HOURS A DAY -



Down in Galveston, Texas, there is a real proving ground for diesel stamina and dependability. Here the ferry boat "Galveston", during the busy summer season, plies across the mouth of Galveston Bay on a round the clock schedule. This busy "double ender" ferry never even turns around in its 24-hour schedule—making the trip one way in forward and returning in reverse.

The dependable power that is so vital a requirement for this rigorous schedule is provided by an Enterprise Diesel equipped with Bendix Fuel Injection Equipment. Just another demonstration that where dependability is a prime requisite Bendix Fuel Injection equipment is the logical choice.

—WITH

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FUEL INJECTION EQUIPMENT

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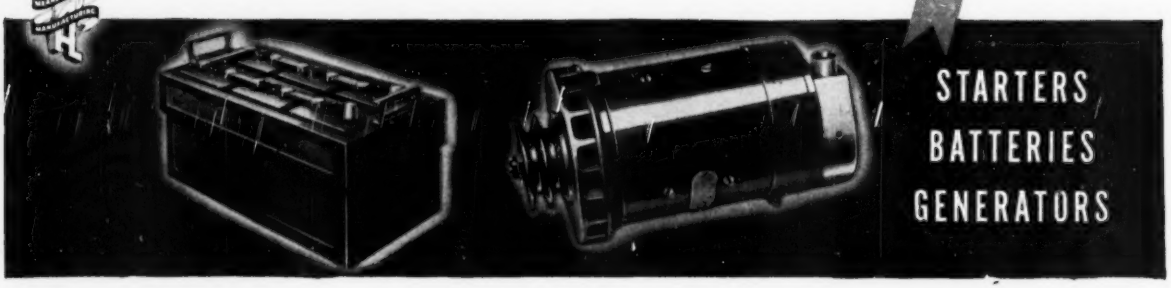
Money cannot buy better diesel equipment . . .



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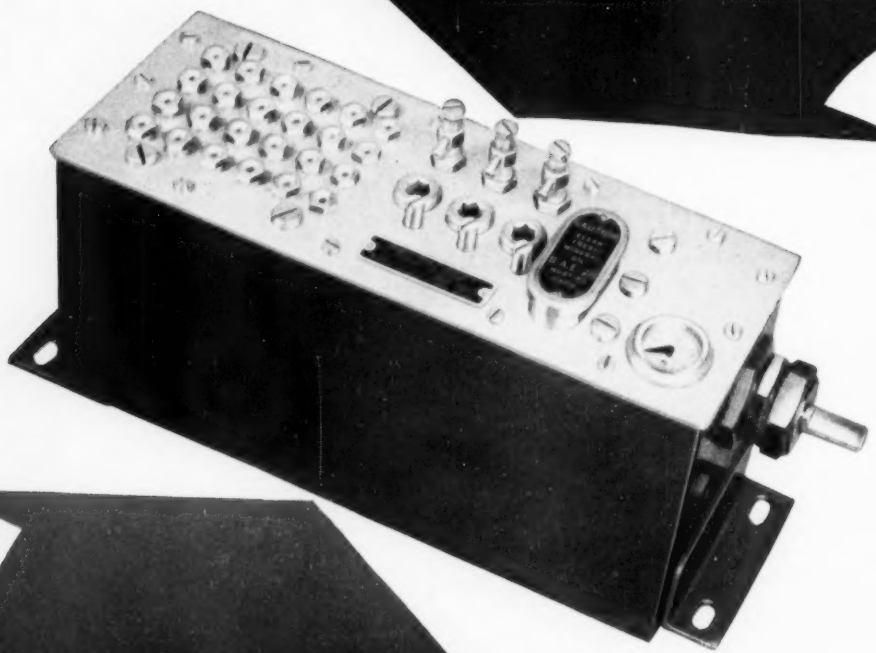
SAVE WEAR AND FUEL—
KEEP YOUR DIESELS CLEAN!
Are your diesels as CLEAN as they might be — completely free from sticking rings, blow-by, sluggish valve action, and accumulated deposits? It pays dividends in less maintenance cost and lowered fuel bills to make doubly sure the oil you use is actually keeping your diesels clean.
Many operators have found that Sinclair GASCON Oils clean engines while they lubricate. GASCON Oils help stop sludge and varnish from forming, keep valves, pistons, rings, and other vital parts free from deposits and gums.
For "tough" service—continuous top loading, frequent idling, high jacket and oil temperatures, use heavy-duty, additive-type GASCON Oils HD.
SINCLAIR DIESEL OILS
keep engines Clean
For lubrication counsel, see your nearest Supplier of Sinclair Products or write direct to Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

MADISON-KIPP

Fresh Oil LUBRICATORS



THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED!

MEASURED FEED DROP BY DROP FED UNDER PRESSURE!

MACHINE performance is in direct relation to the quality of the oiling system! And that's why builders of America's finest machine tools, work engines and compressors specify Madison-Kipp "Fresh Oil" Lubricators as original standard equipment . . . because they provide the most dependable oiling system ever developed . . . measured feed, drop by drop, fed under pressure. There are six models to meet almost every application requirement. Illustrated is the Model FD. Please address all inquiries to the home office in Madison, Wisconsin

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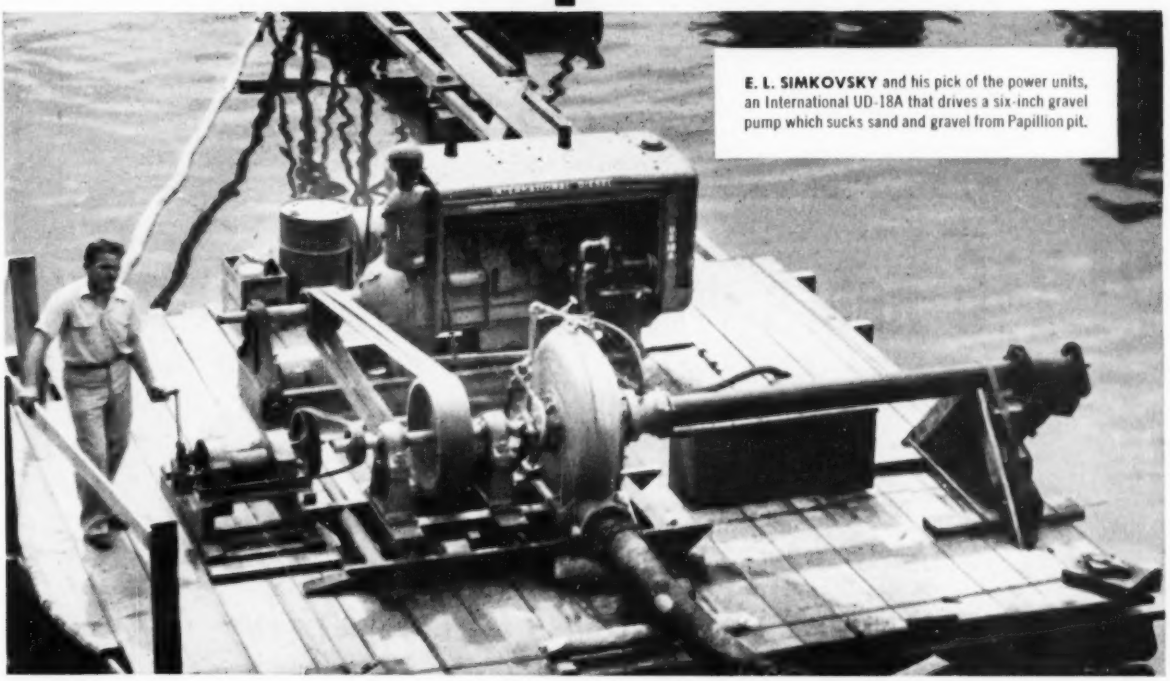
SOME PUMPIN'
at Papillion



E. L. SIMKOVSKY and his pick of the power units, an International UD-18A that drives a six-inch gravel pump which sucks sand and gravel from Papillion pit.

New Gravel Pit Owner Finds International UD-18A Backs Up His Judgment in Picking an Engine

"I looked them all over before I bought an engine for my first sand and gravel plant," says E. L. Simkovsky of the Richland Sand & Gravel Company, Papillion, Nebraska.

"I studied power curves and fuel consumption charts. I visited a lot of installations. I wanted the best.

"And I got it—an International UD-18A. The power is even more than I hoped for, and it's very easy to start and economical to run. It has backed up my judgment in every way."

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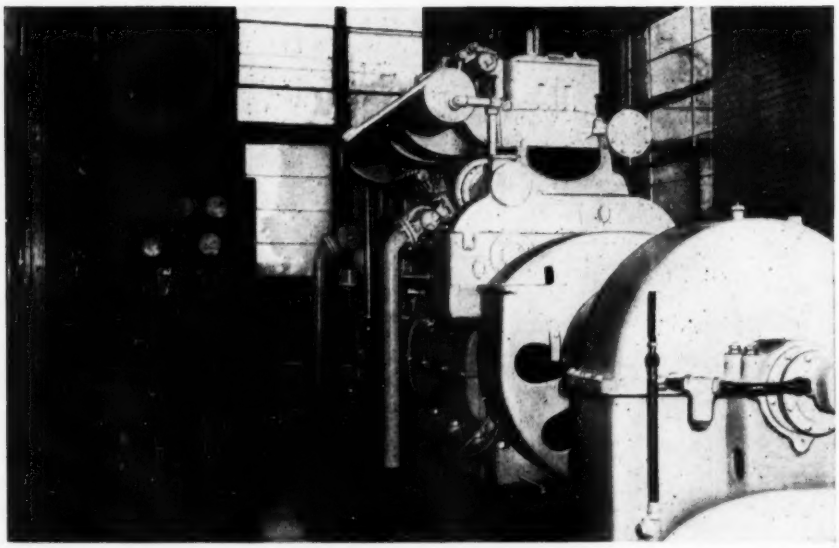

21,716 hours without forced shutdown

. . . and still going strong

that's the record of this Alco Diesel Engine at Barnett Station of Shell Products Pipe Line

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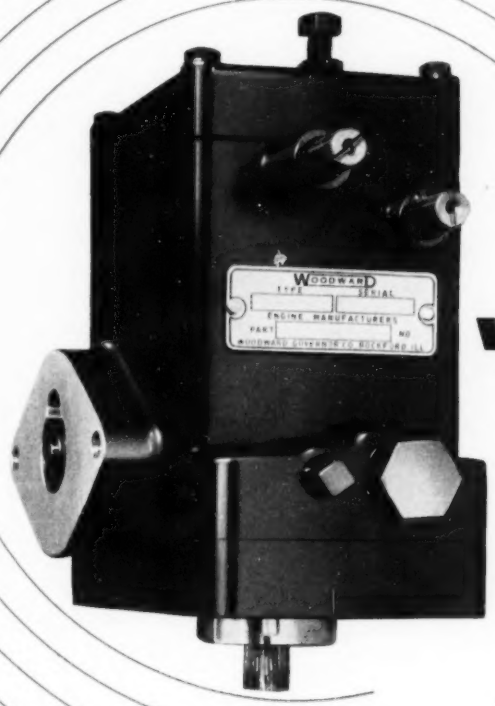

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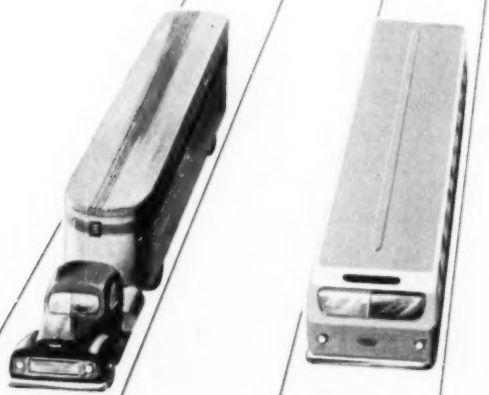

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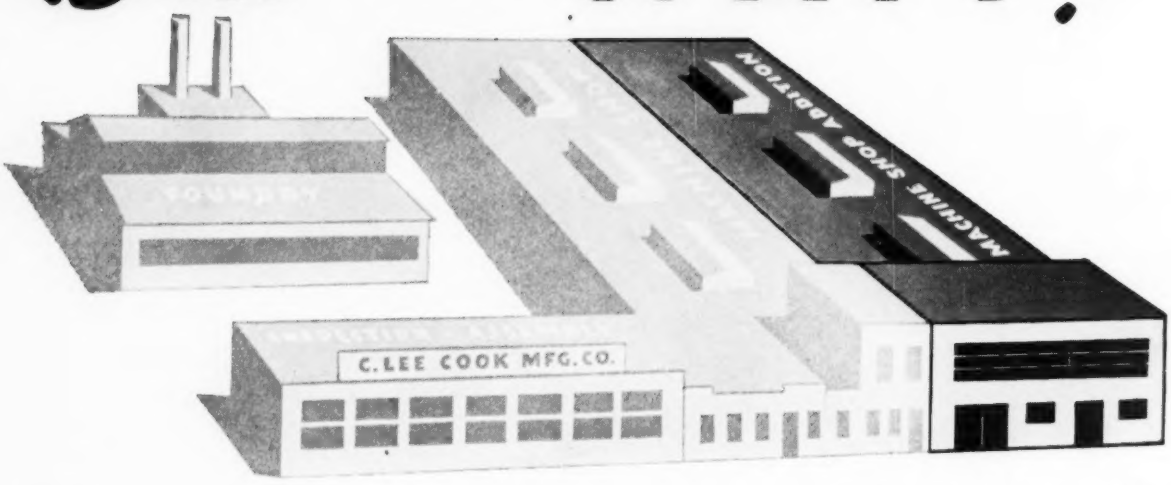

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and DIESEL TRANSPORTATION

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Hard hit by the rampaging Missouri River, West Bottoms in Kansas City, Missouri, starts its big clean-up job. Diesel power, here exemplified by a Caterpillar D4 dozer, is playing a big role. Note the highwater mark on the freight car.

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ARE YOU ON A MAINTENANCE MERRY-GO-ROUND?

Every year, the United States spends the fantastic sum of *over eight billion dollars* just on maintenance of its industrial plant—sad proof that too many companies are on a "maintenance merry-go-round"!

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Editorial:

Mid-Year Report on Rearmament

THESE comments are taken from Defense Mobilization Director Charles E. Wilson's second quarterly report on our Defense Mobilization Program. Entitled "Meeting Defense Goals — A *Must* for everyone", Mr. Wilson feels so strongly about the subject matter that he has recommended publicly that it be sold in drug-stores and other public places. Whether we like it or not, each individual and each segment of industry is integrated in this Program and its progress should be of interest.

Mr. Wilson is very emphatic that the " . . . program must and will continue whether or not the fighting stops in Korea". During the quarter, the goals of military build-up (manpower) have nearly been reached. However, in spite of the fact that close to $10 billion was obligated in this period for military goods and facilities, the military production program is reported as being in the "tooling-up stage". Industry can take its cue from this that the full impact of material shortages has not been felt and plan accordingly.

Interesting figures in support of our foreign committments are given. From personal military experience, we subscribe to the opinion that it is our productive capacity that wins our wars. In this respect, Mr. Wilson points out that the free world out-produces the Soviet Bloc 3 to 1 but that if Europe were lost it would be a 49 per cent - 51 per cent split in favor of the Reds.

Our modern economy is geared to oil and this is certainly the case in the diesel industry. Currently, the free world controls 94 per cent of the known reserves. If the Middle East were lost to the Soviet Bloc we would only have 51 per cent, an uncomfortably close margin.

In manpower, the picture is more dismal. We now encompass 68 per cent of the total population within the free world, but the loss of Europe and Asia would leave us only 23 per cent. The question is, "With a fairly even split in production capacity (our ace in the hole) and the oil products for the operation of our machines, could we off-set the disproportion in sheer manpower?"

The Rearmament Program, ECA and the Atlantic Pact are all evidence that we do not wish to run the risk involved. Our problem is to support these vital projects while at the same time maintaining our civilian economy and way of life. This means production — production — and more production. Material requirements are in direct proportion to our output.

Production takes power. The Defense Electric Power Administration, according to Mr. Wilson, has set a target of 97 million kilowatts of capacity by the end of 1953, or an increase of nearly 40 per cent in three years. Diesels will play a part in this expansion and this is only a single phase of power application.

Steel production capacity is moving toward 118 million ingot tons by mid-1953. Some diesels, locomotives etc., are used here. Aluminum is aimed at nearly 1.5 million tons a year by mid-1954. This will roughly double the capacity existing at the start of the Defense Program. Here, again, the internal combustion engine is playing its role: Witness the existing Alcoa Point Comfort plant, Reynolds Metal's Jones Mill plant and those now in process of construction.

The petroleum situation is a tough one. Mr. Wilson points out that the U. S. is currently " . . . dependent on foreign sources for nearly a million barrels a day, and the nations of Western Europe must rely on imports for virtually their entire production . . . A loss of Iranian oil [to Europe] might force a drastic readjustment in our own pattern of distribution".

As a means of increasing our available crude reserves, a goal of 43,400 new wells has been set for 1951. Wildcat drilling has risen to a level 25 per cent above that of early 1950. Additional refinery capacity to the tune of 1,000,000 bbl. per day is approved and under way.

Goods have to move so transportation has to be considered. Diesel locomotive and freight car production has to be stepped up.

We have chosen only a few pertinent portions of the Report for comment: It must be obvious that every phase of our economy would be covered. This editorial was intended to point out some of the recent progress toward our national goal and to emphasize the high degree of complexity and integration of our system. The diesel industry has an extremely important role in this system. Just as the events of modern history can affect us so can we affect the course of events in relation to our ability to produce and our technological development.

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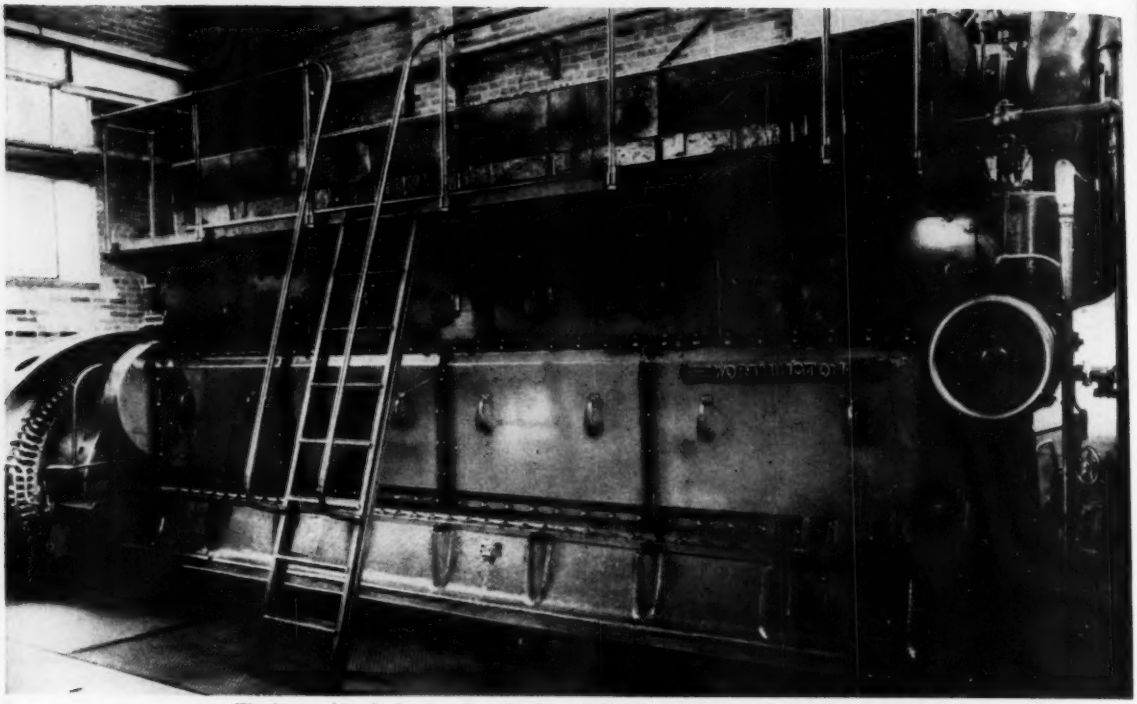

Worthington 8-cylinder 4-cycle turbo-charged Diesel engine—one of the two operated by Elko-Lamoille Power Company. This 1000 Kw-rated engine was installed on the same foundation originally built for an engine with 250-Kw rating.

Lesson in Cost Reduction

FROM THE MIDDLE OF THE DESERT

If you've never heard of Elko, you'll find this story interesting.

Elko is the seat of a county in Nevada that, all by itself, is larger than Massachusetts, Connecticut and Rhode Island together, with Delaware thrown in. Since pioneer days, it has been a transportation and trading center.

Elko's present power plant set-up, which includes two four-cycle turbo-charged Worthington Diesel engines connected to 1000-Kw generators, contrasts with the single 50-hp steam engine purchased second-hand in 1896 from a nearby silver mine.

Cost of power has never been more reasonable. Ever since 1940 when fuel oil cost this plant less than half what it does now, power rates have *gone down*—having been reduced twice during the period. Today, 87% of the power is produced by the two Worthington units, and in 1950 the plant averaged 13.3 Kw-hrs per gallon of fuel.

Lubricating oil consumption is low, too—well below the estimated 4,000 rated horsepower hours per gallon.

Want more evidence that there's *more worth in Worthington?* Write Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.

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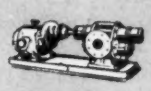

Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Coolers

+ HIGHLIGHTS +

• An oil strike in eastern Montana has further aided us in getting more oil and gas wells into operation.

• Diesel-electric locomotives now handle nearly 50 per cent of all road freight traffic as measured in gross ton-miles and nearly 60 per cent of the road passenger service as measured in passenger car-miles.

• The Brownville, Texas synethetic plant is now producing 7000 bbl. of gasoline and other petroleum products from natural gas.

• Production of crude oil in the United States went above the six-million-barrel-a-day mark for the first time in history during the week of April 14, 1951.

• Aggregate net sales of all G. M. products totaled $1,921 million for the second quarter of 1951, with the net income $139 million. Earnings on the common stock, after deducting dividends on the preferred stocks, amounted to $136 million, or $1.55 per share.

• With present scarcity of alloying materials, hand tool manufacturers are being urged to experiment with boron treated steels as substitutes. These steels have assumed new importance because of their ability to be hardened.

• At the present rate of increase the power consumption of the United States by the year 2000 will equal the current consumption of the entire world, or about 25 trillion hp. hours per year, according to G. W. Gleeson, dean of the School of Engineering and Industrial Arts at Oregon State College.

• The tool steel industry is reported as saving scarce tungsten at a rate of 360,000 lb. per month through voluntary efforts.

• Automotive taxes were the biggest money raiser for state governments last year, providing almost one-third of all state tax revenues.

• There is at the present time a shortage of native sulfur and some of its uses must be curtailed so that the supply will be channeled to the most essential needs. Suggestion—how about using the sulfur in some of our present fuel oils?

• General Motors produced 176,028 passenger cars and 46,684 trucks in its United States plants during July. In the same period last year it produced 263,635 passenger cars and 49,412 trucks.

• Class I railroads installed in service 1309 new locomotives during the first six months of 1951. Of this number 1299 were diesel, 8 were steam, and 2 were electric.

• Repressuring of old Oklahoma oil fields by means of water flooding began in June. In this type of repressuring, water is injected into the oil bearing formation through wells drilled for the purpose, forcing the oil to flow to existing wells. It is estimated that almost as much oil as originally came from these fields can be recovered.

• Motor vehicle registration in New York State reached 3,640,820 during the first five months of 1951, or a gain of nine per cent over the same period last year.

• Petroleum and natural gas provided 54 per cent of the nation's energy supply in 1950.

• Allegheny Ludlum Steel Corporation reported sales and revenues for the second quarter of 1951 totaling $58,748,747 and after taxes earnings amounting to $2,923,590 or $1.80 per share of common stock.

• International Nickel Co. has announced a new alloy, Incoloy, for use under conditions of high temperature and corrosion. It conserves critical materials containging 35 per cent nickel, 20 per cent chromium with the balance iron. It is supposed to substitute for older 70 per cent nickel alloys.

• Nine new 1200-hp. Baldwin-Lima-Hamilton road switchers will take over operations from 11 steam locomotives on the N. Y. Central's Putnam Division. With delivery scheduled for September, crew training is underway with a similar unit borrowed for the purpose from another line.

• A new military equipment repair policy plans for the use of commercial facilities for depot-type maintenance of Army, Navy and Air Force equipment. Current maintenance needs are being surveyed.

• Withdrawal from storage of industrial machinery in the National and Departmental Equipment Reserve has been directed by the Munitions Board in appropriate cases. These machine tools will be used in preference to buying new equipment in meeting current production needs of the Armed Forces.

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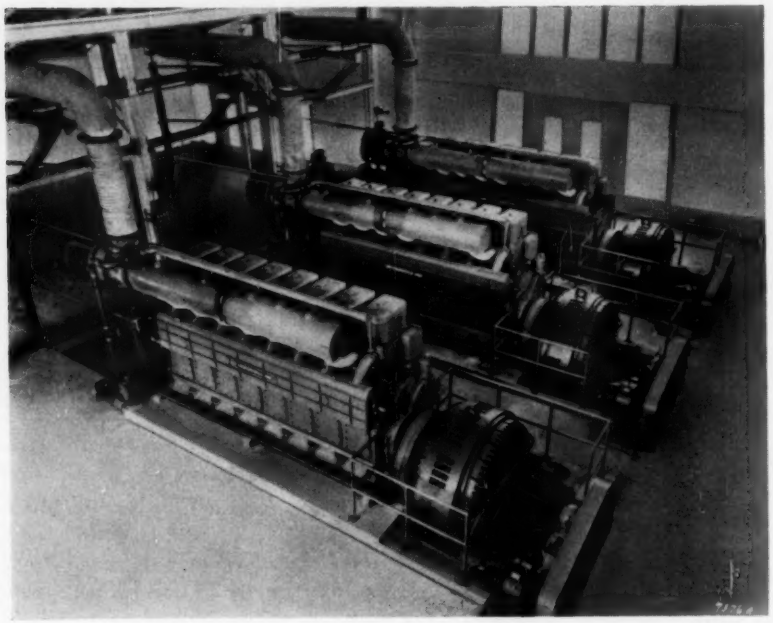
Nordberg's "Supairthermal" Engine

Culminating six years of research, development and testing, Nordberg has announced their Supairthermal* engine with ratings showing one third more horsepower than identical but conventionally turbocharged engines. By utilizing a well known but originally applied principle of thermodynamics, the increased horsepower is attained without increasing the internal surface temperatures and pressures. Thus, all of the advantages attendant to the principle of turbocharging are received in fuller measure without adding to the dynamic and thermal stresses in the engine.



Installed at Nederlandsche Indishe Gas Maatshappen, a public utility at Aruba, N. W. I., are three Nordberg Supairthermal engines. Each engine is rated ct 1400 hp., 1000 kw. at 450 rpm.

MOST modern diesel engines, although structurally able to yield a greater horsepower, have reached the point where their safe rating is limited by the inability of the surfaces in contact with the combustion gases to continuously stand higher temperatures without heat failure or destruction of piston ring lubrication.

Turbocharging 4-cycle diesel engines, introduced in America by Nordberg, marked one of the earlier achievements in overcoming these limitations and resulted in increasing engine ratings by 50 per cent.

The next significant advancement made by Nordberg in increasing the capacity of a 4-cycle supercharged engine was to cool the intake air after the turbocharger. Intercooling, as it is termed, is accomplished with a finned tube type of air-to-water heat exchanger built into the engine and through which the cooling water is circulated before going to the regular jacket water cooling system.

Where cooling water is available at a temperature that will cool the intake manifold air temperature to 90°F, (DEMA Standards provide for rating diesels on the basis of 90°F intake air conditions) intercooling will raise the allowable engine rating about 15 per cent with no greater heat load to the cooling water and with no increase in surface temperature.

Nordberg's latest advancement in diesel engine performance, the Supairthermal engine, uses the "Miller System of Supercharging". These engines are built for operation on diesel fuel, duafuel, or spark ignited gas Mr. Miller has documented the progress of his work in this field in numerous technical papers. His most recent detailed his calculations and test results that produced the system incorporated in these engines.

The paper, entitled "The Effect of Charge Temperature and Pressure on Rating of Diesel Engines and a Variable Compression Ratio Supercharging System for 2 and 4-cycle Internal Combustion Engines" was presented at the 1951 Annual Conference of the Oil and Gas Power Division, ASME.

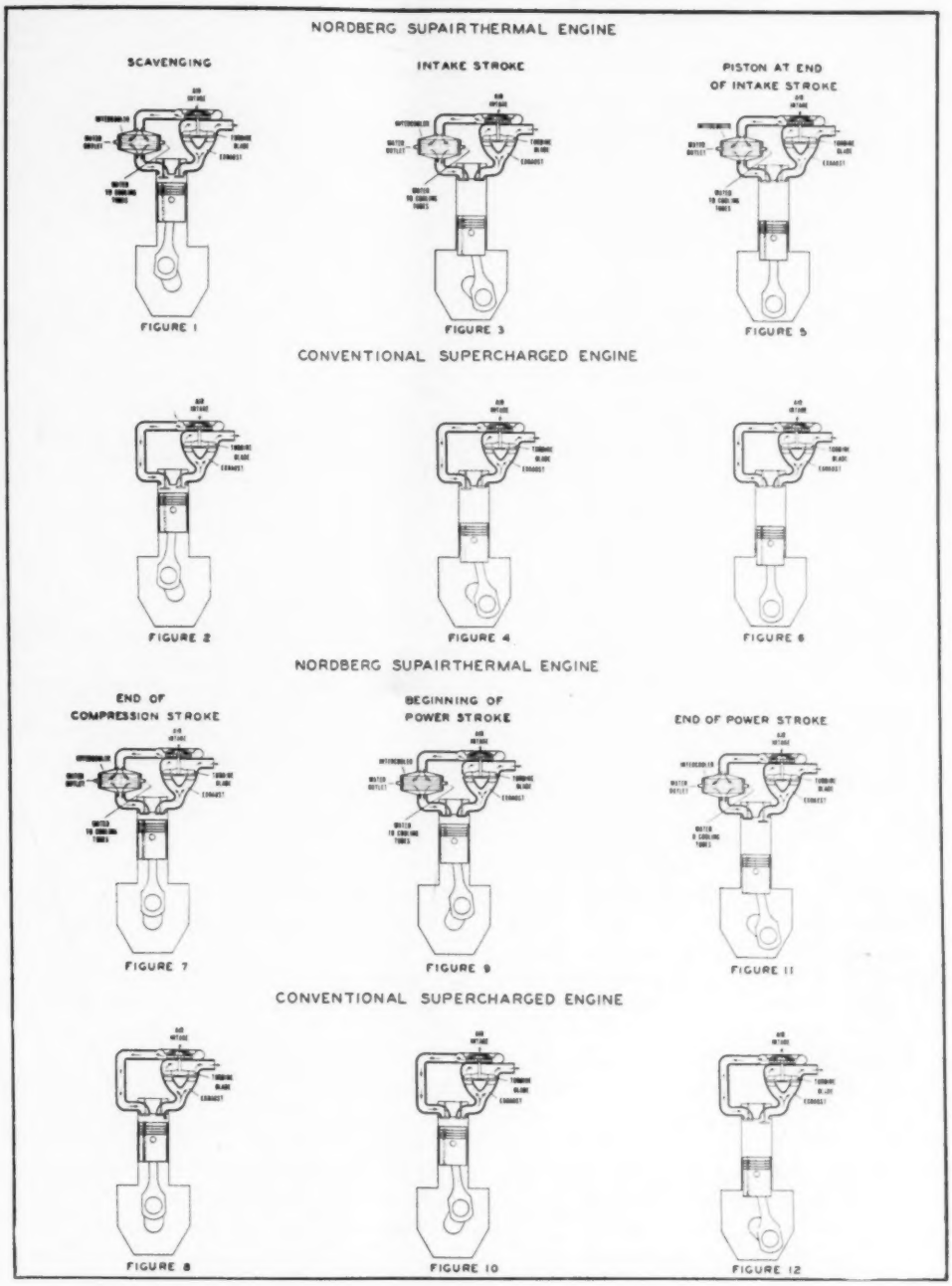
He has long advocated the reduction in charge temperature as a means of increasing the safe horsepower rating per cylinder and further, stresses that . . . "thermal efficiency is a function of expansion and not compression ratio, as is too often assumed". These ideas are reflected in his system.

Conventional turbocharged engine performance is improved in four important ways:

1. A greater amount of cooling within the cylinder is accomplished by blowing a larger volume of cooler scavenging air through the cylinder and the exhaust pipe.
2. The turbocharger delivers air to the cylinder at higher pressure, thus providing 30 per cent more weight of air, making it possible to burn more fuel.
3. By means of an intercooler on the discharge side of the turbocharger, the temperature of the intake air is cooled before it enters the cylinder.
4. By closing the intake valve before the end of the intake stroke, the air within the cylinder is expanded from 15 lb. pressure to 6 lb. pressure (at full load) and the intake air is thereby cooled another 50° F.

The turbocharger used with the Supairthermal engine, at rated full load, delivers air to the intercooler at 15 lb. pressure. Because of this com-

*Patents Pending



Graphic comparison of the Supairthermal and a conventionally supercharged engine. Relative conditions within the cylinders are given in the captions below. For further comparative data see Chart I on next page.

Fig. 1 The 3-lb. pressure difference between input to turbocharger and blower output provides high rate of scavenging air flow that removes exhaust gas and cools combustion chamber. Air enters cylinder at 15 psi. and 100°F.

Fig. 2 By comparison, the 1¼-lb. pressure difference in a conventionally supercharged engine provides only moderate rate of scavening air flow.

Fig. 3 Intake valve closes 45° before end of stroke. Air then expands to end of stroke.

Fig. 4 By comparison, intake valve remains open till end of stroke.

Fig. 5 Both intake and exhaust valve are closed. Air has expanded to 6 psi. and 50°F, providing additional cooling. Compression begins.

Fig. 6 Both intake and exhaust valves are closed and compression begins.

Fig. 7 Combustion chamber contains 30 per cent more weight of air than conventional engine. Temperature is 792°F; pressure- 648 psi.

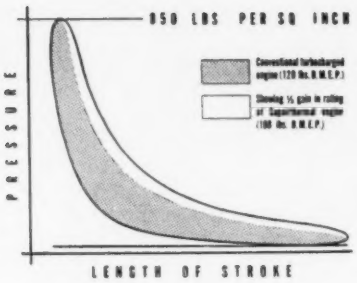
Fig. 8 Conventional combustion chamber contains air at 1010°F and 580 psi.

Fig. 9 Combustion continues through 10 per cent of stroke. Temperature is 3120°F; pressure-850 psi. Expansion starts. Increased length of stroke through which combustion continues increases bmep.

Fig. 10 Combusion continues for 6.7 per cent of stroke. Temperature is 3390°F; pressure-850 psi. Expansion starts.

Fig. 11 Exhaust valve opens. Temperature is 1232°F; pressure- 62.8 psi.; mip.- 187 psi.

Fig. 12 Exhaust valve opens. Temperature is 1205°F; pressure- 43.2 psi.; mip.- 144 psi.



Left—Indicator card showing gain in rating of Supairthermal engine over a conventional turbocharged engine.

Right—Chart giving comparison of conventional turbocharged engine with engine operating on Supairthermal principle. Both engines are operating under identical conditions.

CHART I

	Low Pressure Supercharged (Non-intercooled)	Supairthermal Engine
Engine Bore and Stroke (inches)	13 x 16-1/2	13 x 16-1/2
Revolutions per minute	450	450
Piston Speed (feet per minute)	1237.5	1237.5
Maximum firing pressure (psig)	850	850
Brake horsepower for continuous service	150	200
Brake mean effective pressure (psi)	120	160
Ambient temperature (°F)	90	90
Air temperature at supercharger discharge (°F)	142	250
Air temperature to intercooler (°F)	---	250
Water temperature to intercooler (°F)	---	90
Air temperature after intercooler (°F)	---	100
Air temperature entering engine (°F)	142	100
Air temperature at beginning of compression (°F)	142	50
Air Pressure at supercharger discharge (psig)	4	15
Air Pressure entering engine (psig)	4	15
Air Pressure at beginning of compression (psig)	4	6
Heat to cooling water Btu/minute per Brake Horsepower	16.20	12.15
Total Btu/minute at above rating	2430	2430
Heat to lubricating oil Btu/minute per Brake Horsepower	5.56	5.80
Total Btu/minute at above rating	1000	1160
Heat removed by intercooler Btu/minute per Brake Horsepower	--	8.2
Total Btu/minute at above rating	--	1645
Typical Comparable Fuel Consumption Rates on Dynamometer test Pounds/BHP/HR		
Full Load	.375	.369
3/4 Load	.37	.355
1/2 Load	.375	.365
Mechanical Efficiency at full load (%)	83.2	85.4

pression within the turbocharger (from atmospheric pressure to 15 lb. pressure), the air temperature increases about 160° F. The intercooler cools the air to within 10° F of the cooling water temperature. With 90° F the cooling water, the air enters the engine cylinders at 15 lb. pressure and 100° F.

The point at which the intake valve closes during the intake stroke is automatically controlled by the pressure in the intake air manifold. For example, with a 15 lb. manifold pressure, which is normal at full rated load, the intake valve closes 45° before the end of the intake stroke. This is an important difference between the Supairthermal cycle and that of the conventional supercharged engine where the intake valve remains open until the end of the intake stroke.

The air in the cylinder is expanded from 15 lb. pressure to 6 lb. pressure as the piston continues downward to the end of the stroke. Because of this expansion, the temperature drops from 100° F to 50° F. As the manifold pressure decreases at part loads, the intake valve closes later so that the air pressure at the beginning of the compression stroke remains 6 lbs. At light loads where the intake manifold pressure is 6 lb. or less, the closing of the intake valve is fully retarded and the pressure and temperature at the beginning of the compression stroke is the same as in the intake manifold after the intercooler.

The illustrated comparison (Figs. 1 through 12) of the various stages in the intake, compression and power strokes of the Supairthermal engine and the conventional supercharged engine clearly shows the way in which the engine output is increased.

Along with this increase in power, tests have shown greater thermal efficiency. This, together with higher mechanical efficiency due to the fact that frictional and other parasitic loads remain substantially constant regardless of cylinder output, results in better fuel consumption characteristics and more hp.hr. per gal. of lube oil.

Increased output without a corresponding jump in engine size and weight will provide the advantages of less weight and size per hp. and thus lower installational cost per hp. Cooling equipment can be smaller than might be expected on the basis of horsepower since the heat rejection to the cooling water is the same as for the conventionally supercharged engine.

Supairthermal engines are available in a size range of 4-cycle units from 425 to 3200 bhp. for both stationary and marine service. There are engines in both of these fields currently in operation.

Three 1400-hp., 1000-kw. units turning at 450 rpm. are installed at Nederlandsche Indishe Gas Maatschappen, a public utility at Aruba, N.W.I. Another, rated 2100-hp. at 327 rpm., is operated by the Florida Power Company at Fernandina, Florida. An 800-hp. unit, turning 300 rpm., has been installed in new tug owned by the Foss Launch and Tug Company of Tacoma, Washington.

The Supairethermal engine represents an important engineering advance in that it is the first commercial application of the high pressure turbocharging principle. It should be pointed out that the results achieved are obtained with equipment currently in production.

In his paper, Mr. Miller says, ". . . efficiency of the impulse type turbocharger now available is too low to give complete scavenging with a single duct manifold. . . However, a newly developed reaction type turbocharger, which is now being tested and soon will be in production, has characteristics that will permit us to operate multiple cylinder engines with single duct exhaust manifolds."

An implication of this development is that the efficiency of this turbocharger would permit application to 2-cycle engines. In fact, Mr. Miller gives a theoretical analysis of the application of his system to a 2-cycle engine that indicates the possibility of a "40 to 45 per cent increase in engine output without increasing heat loads or combustion pressures."

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Washington Slant

SHORTAGE OF HIGH GRADE SCRAP is serious threat to realization of full steel production; so serious that Scrap Mobilization Committees headed by top industrialists have been formed, comprehensive advertising campaigns undertaken, and all other media used to alert industry to the danger. To get steel, we have to make it and to make it, scrap is needed. Let's clean out obsolete machinery, tools, jigs, dies, etc.

AMENDMENT TO NPA REG. 2 liberalizes provisions for use of DO ratings to replace materials taken from inventory. Extension of rating is permitted three months after receipt of rated order or one month after using inventory materials to fill. New DO identifying symbols (one letter, one digit, or two or more letters) take precedence over old DO's except for 11 ratings listed in Direction 2 to CMP Reg. 3.

IMPORTED STEEL CAN NOW AUGMENT ALLOTMENTS according to Dir. 4 to CMP Reg. 1. Previously was charged against allotments. Use of copper and aluminum above allotment in connection with use of such steel not authorized. Furthermore, DO rating may not be used for getting products containing controlled materials, except steel fasteners, for a production schedule increased by the use of this steel.

CMP REG. 5 DEALS WITH MRO and replaces revoked NPA Reg. 4. Provisions are essentially the same. Allotment symbol "MRO" with specified certification constitutes authorized controlled materials order. DO-MRO rating is extended for non-controlled materials. Quantities, usage, etc., are defined in the Regulation. Outstanding DO-97 rated orders, placed before effective date of Regulation (July 6, 1951), now have equal preferential status as the MRO or DO-MRO rated orders.

USE OF MRO SYMBOL AND DO-MRO RATING was later broadened by amendment of CMP Reg. 5. Permits controlled materials producers to deliver orders where materials come within new definition of "operating supplies". Also, certain painters and industrial brushes can now be obtained with DO-MRO rating.

CMP REG. 7 IS FOR REPAIRMEN who normally do not have quota under CMP. During any quarter, repairman is limited in amount of controlled materials to: steel (check restrictions)—20 ton; copper (types specified)—500 lb.; aluminum—500 lb. He can extend allotment symbol "RE" with specified certification to obtain quantities *actually* required where customer has no MRO quota under CMP Reg. 5. If customer is eligible for quota or is otherwise authorized an allotment symbol he must use this rather than "RE".

NEW DIVISION, METAL WORKING EQUIPMENT DIV., has been established within the Industrial and Agricultural Equipment Bureau due to increasing realization of the importance of machine tools to foster production. H. L. Tigges, executive V-P, Baker Brothers, Toledo, Ohio, is director.

OTHER TOOLING DEVELOPMENTS include action by Defense Mobilization Director Wilson who instructed DPA, NPA, ESA, GSA, Department of Defense and Atomic Energy Commission to assist Machine Tool Industry by five point program: Modify price controls; Procure adequate facilities, materials and components; Provide for easier financing; Help overcome manpower shortages; Pool orders and encourage subcontracting to assist small machine tool manufacturers. Annual production rate is $675 million with estimated $2.9 billion required by end of 1952.

PETROLEUM AND GAS INDUSTRY USERS now have some priority assistance granted under Supplement 1 to M-46. Following allotment numbers are now available to an operator (as defined in M-46): "H-9", for MRO only; "H-2", material for production operation only; and "H-1", for materials in a construction operation. These are for securing controlled materials and fabricated items. Supplement spells out details and limitations for use, including use to get materials, not controlled but for which priorities assistance may be or may have been authorized.

PETROLEUM ADMINISTRATION FOR DEFENSE is authorized by same Supplement to reschedule deliveries (not orders) of controlled materials to the point of greatest need.

INTERNAL COMBUSTION ENGINE INDUSTRY ADVISORY COMMITTEE informed NPA that military orders for heavy duty engines should not be permitted to cut into civilian supply of such equipment under CMP. Maintained that controlled material allotments should accompany military orders so that manufacturers will not have to use civilian allotments to fill military needs. Engines are now listed as "B" products with NPA allotments on basis of authorized production schedules for both civilian and military needs. Military specifications make the engines non-standard and, thus, should be "A" products with accompanying allotments.

"Grass Roots" Report

on various developments, problems and points of interest concerning the diesel industry

In elections, there are the various polls; in industry, there are various surveys. How, then, does a Technical Society find out what is going on in the field? The Oil and Gas Power Division, ASME, depends largely on a large General Technical Committee whose members are widespread both geographically and in field of interest. They are the "grass roots" of the organization and twice yearly present their findings in open meetings. Here are selected comments condensed and extracted from the minutes of the meeting held in Baltimore some time ago.

Comments on REA

MR. WILLIAM REED, REA—There is little need of going into the importance of diesel engines in the REA program. There was about 320,000 kw. of power-generating equipment installed by 1949. Of that 223,000 kw., or 75 per cent of our total installed capacity, is diesel.

Average unit size installed before the war was about 600 kw. Directly following the war, average size increased to about 1100 kw. Today, most of our studies seem to indicate there will be a greater number in the 2000-kw. or larger range.

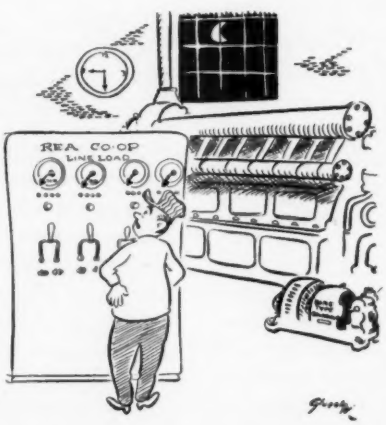
Our plants, as well as the units, are growing larger with time. That is evidenced by the large number of steam plants being set up. It would appear there may be a market for a large-capacity diesel engine that can compete with a small steam plant, burning cheap fuel.

Briefly, REA, in arriving at a type of prime mover for a generating plant, bases its selection on the lowest estimated cost per kilowatt hour. These diesels really can help in producing electricity at a low cost, keeping investment at a low figure and having long life, keep depreciation charges down.

Most units REA uses are in the heavy-duty class. We define "heavy-duty" as the ability to operate twenty-four hours a day, indefinitely, with a small amount of time out each year for maintenance.

Capacity is usually established by estimating maximum peak the plant is expected to meet during the year. This means that in isolated systems, where the diesel plant is the only power source, the plant operates at a low load factor. During winter nights load can go down to 25 per cent of the capacity of any unit in the plant. Later, we may be operating at overload capacity of the same unit. The diesel is rather well adapted to this type operation because it has a flat fuel-consumption curve.

To obtain heavy-duty equipment we must establish rather definite limits. Present piston speeds are held to 1250 fpm.; rotating speeds are about 360 rpm. for units around 1000 kw. and larger. They scale upwards in speed to about 720 rpm. for units of 200 kw. or less. Our bmep. is set at 120 psi. for 4-cycle, supercharged engines; about 85 psi. for normally aspirated 4-cycle and 2-cycle engines.



"Well, guess everyone's gone to bed—turn on the little one".

We have installed a few units we call the locomotive-class engine; about 1000 kw., operating at 720 rpm. These units are installed where they will be depreciated in about ten years. The plants are either on standby service or an additional power source for the area.

We keep rather close watch on development. Of interest is the high-pressure supercharger, with the aim of upping maximum bmep. We also are following experiments in supercharger air-cooling, before-and after-cooling.

There are a few improvements we think could be made in present installations. One of them is part-load performance of the dual-fuel engine. Total heat rate of a dual-fuel engine is generally better at full load than is a diesel. But, on reduction, approaching half load, fuel consumption goes up very rapidly, even on some of the more modern engines.

Regulation of some dual-fuel engines is not up to the standards we were used to in an oil burning diesel.

Then there is the question of crankcase explosions. There has been an effort to minimize and eliminate them, but occasionally we hear of one or have one which makes it appear that the problem is still with us.

We are interested in selection and application of auxiliaries to go with

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the engine. An REA project must, of necessity, include all these.

We have found that with the supercharged engine the lubricating oil purifying equipment has been short on capacity. Possibly, standards for picking filter equipment on basis of horsepower need revision.

Also, cooling equipment is sometimes short in capacity. We have several projects where heat exchanger surface is probably adequate as long as it is clean. But we find on a hot day and at peak load that we are unable to control engine temperature because of a small amount of scale in the heat exchangers. Sufficient additional surface should be included.

Modern engine temperatures raise those of the raw water in the heat exchanger to the point where it is giving us considerable scaling trouble on the raw-water side. It is now regular practice among our plants to treat raw water. It also eliminates, pretty generally, the use of jacket water for lubrication oil cooling.

U.S. Army Switchers

ALBERT A. FRY, TRANSPORTATION CORPS, U. S. ARMY—In the work we are doing at present, one requirement is the limitation that we build equipment or have equipment to meet the restrictions of foreign railroads. We use a great many diesel-electric locomotives which are practically standard on American railroads, but where equipment might be used overseas, we are greatly restricted.

I would like to discuss a diesel-electric locomotive that we recently put on test. It is a 50-ton road switcher.

Many railroad men claim that this is a switcher and not a road switcher, but we have to build small locomotives and use them for road and switch work. This particular unit was built under some restrictions. we were dubious as to whether they could be met. We started with a 50-ton locomotive.

One requirement was that it use diesel engines between 600 and 800 hp. When we began looking for suitable engines we were surprised not to find them on the commercial market. Engines in that range were too heavy for this type locomotive. Also, restrictions prevented a locomotive over 12 ft., 11 in. high nor more than 9 ft. wide. Then to make the matter worse, we had to have a clearance underneath the locomotive, due to some restrictions in foreign railroads, of 7⅞ in. or practically 8 in.

We were getting a lot of locomotive in a very small space. At 3 ft., 6 in. above the rail we had to cut the width down to 8 ft., 6 in. At a foot above the rail we had to cut it down to 7 ft., 6 in. Lastly the locomotive was

"Yup! That new rubber construction meets all operating conditions—now if we could get a rubber engineer—".

to operate on 56½-in., 60-in., 66-in. and 67-in. gauge. Trucks were not to be changed. We came up with an answer and built a locomotive.

In the meantime, after certain tests made in the yard, more equipment was required on the locomotive. When we finished, we had 55-ton nominal weight and a 57-ton locomotive in working condition.

The only engines available at the start were experimental units built by Cummins. We could not use a heavier engine because we would have exceeded our weight limits. We had to go to higher speeds to get lighter traction generators. Two Cummins NCHS engines were purchased and connected to GE generators. Speed was reduced from 2100 to 1800 rpm. and engines rearranged and rerated to give us a total of 730 hp. or about 650 hp. at the traction motors.

There was another restriction, a temperature limitation. The locomotive had to operate satisfactorily at temperatures of 125° F maximum and minus 40° F minimum. We got around that with insulation and heaters, but weight was added. We lost some horsepower, of course, due to bigger fans and larger radiators to take care of the 125° F limit.

The locomotive has an overall length of about 37 ft. 5 in. Length between end sills is about 34 ft.

We are operating the locomotive on the New York, Ontario and Western Railroad. It has been under test for a short time and we have had a few normal troubles considering it's a new type of engine. We consider it is experimental, but it is working satisfactorily. We've had a little trouble keeping the engine balanced. This is most important when handling loads and we are planning to put hydraulic governors on them. The locomotive hasn't been in service, we consider, long enough for proper evaluation of test data.

Mine Locomotives

MARTIN ELLIOTT, BUREAU OF MINES—Some people do not know when they are well off. These meetings point up one thing—the problems in operating diesel engines in the great outdoors. Some people want to put them in holes in the ground and complicate their operating difficulties even more.

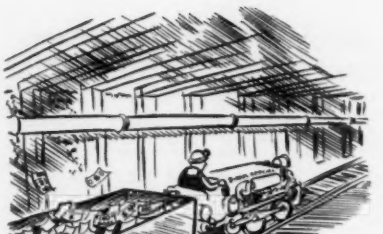
Interest of the Bureau of Mines in this particular development stems from the fact that the diesel engine looks as though it might offer a very safe substitute for the hazardous trolley locomotive in underground operation. There are other advantages, all well known to the diesel fraternity.

My connection with this development extends back as far as 1938 when the Bureau first undertook its studies of some of the hazards that might be

encountered in underground operation. These are the discharge of harmful and objectionable gases in confined space underground and, in certain applications, such as coal mines, the explosion hazard that might be created by the engine.

We have had a little operating experience over the past ten years in underground applications and many companies have had considerably more. Ours has been in use of diesel locomotives in the Delaware Aqueduct, an 85-mile tunnel that it no longer big enough to supply New York City with water. Certain sections of this tunnel—one section in particular—was mucked with diesel locomotives, and two sections were lined using similar power equipment.

Recently, the Bureau of Mines has had some experience of its own in the operation of such equipment in an oil-shale mine at Rifle, Colorado, where an underground quarry operation is involved. They have complete diesel haulage on two branches out there at an altitude of 7500 or 8000 ft. The problems are: ventilation to dilute and remove harmful and objectionable gases; and fuels containing quantities of sulphur.



"Huh! Another shipment to Jack Benny's vault. Well, at least he's up to date".

Strangely enough, if you supply sufficient ventilation for a proper operating condition to dilute carbon dioxide to an allowable level, (0.5 per cent for continued exposure) then, in most engines, you will automatically take care of the other gases, such as carbon monoxide and oxide of nitrogen. This means that approximately 25 volumes of ventilating air per volume of exhaust gas are required.

The explosion hazard must be considered in coal mines and the Bureau of Mines has conducted investigations to determine the significance of this hazard—how bad the diesel is as a source of ignition in flammable atmospheres, and also to determine the effectiveness of methods of minimizing or eliminating this hazard.

As a result of this work and the field experience, there have been two schedules drawn up for approval of equipment for use underground. The first of these is for the use of the equipment in coal mines and the second one is in non-coal mines. The difference is that the coal-mine schedule requires permissible explosion-proof equipment, the non-coal mine, not.

A word about locomotive size might be of some interest. We are talking about the 10 to 15-ton size range.

I should mention that development in Europe, particularly in England, France and Germany, is further ahead of us. They have had diesel locomotives underground for many years.

Railroad Fuel and Lube Problems

W. R. Senoff, Test Engineer, Baltimore and Ohio Railroad—I am not speaking for any railroads, or railroad men; I am speaking for myself. So my mistakes are my own. There are two things, however, that concern me and perhaps some other railroad men more and more as railroads become dieselized. First, fuels.

During the first ten years of railroad dieselization we paid more attention to the diesel itself and its performance on our line than we did to other things involved in its operation. As we became pretty well dieselized, however, we were told that fuel costs more and that fuel and lubricants used in diesel engines affect the overall cost of maintenance and reliability of operation.

Next, we ran into the possibility that good fuel, as we knew it those first ten years, would not be with us very long. We did not pay too much attention up to maybe a year ago. Now, on the East Coast at least, it appears we are burning 40 per cent cracked fuel and 60 per cent straight run. We do not know how it behaves in our engines.

To DEMA I would like to throw the challenge that I, as a railroad test engineer, would like to see more uniformity in fuel specifications by diesel-locomotive builders. There are five builders and five specifications and no two are alike. The last check I made revealed they only agreed across the board on one item. That item was on BSW (*bottom sediment and water*). They agreed that the BSW was much higher at the maximum than their engines will burn in service. We could not run a diesel out of Baltimore on 0.5 BSW if it happened to be all sediment, very finely divided.

One form of sediment, disastrous to diesel injectors and a sure cause of failure, is very finely divided iron rust. In one case it developed from tank cars that haul aviation gasoline. The oxide film formed before the car was loaded with diesel fuel. This rust is not filterable by any equipment on railroad diesels and will stop them.

Some protection against the divided material mentioned should be incorporated in the engine fuel system. It is a source of considerable apprehension to us on the railroad.

Another matter more closely related to fuel specifications is fuel stability. These cat-cracked fuels are less stable than those we have known in the past. The first thing we learned was that a given fuel was not only unstable, but some fuels that were stable by themselves were unstable when mixed. We are worse off now than we were before.

Stability is not even mentioned in the specifications. Some requirement for stability that will protect us when we want to store this fuel for a number of months is needed. That requirement must have some test to determine if the fuel is stable. We know nothing about it today.

There is a great division of opinion among railroads, including our own, on the next subject. However, engine builders are unanimous in their opin-

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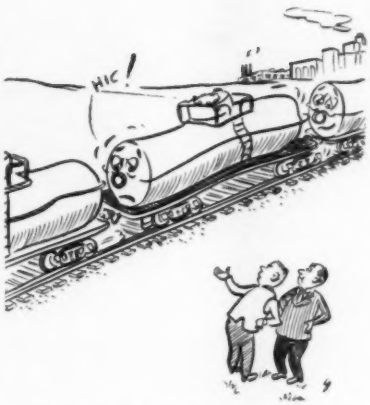
fion and so are oil people. The subject is this: Our railroad has 11,000 miles of track. We are dieselizing rapidly. These diesels have to run from Baltimore to St. Louis, New York, Washington, Chicago and off on branch lines. The Emergency Operating Department wants to grab those diesels because of their flexibility. That was why they bought them. They want to send them wherever they please on an hour's notice.

We have 13 different lube oils. Engine builders say they must not be mixed: Lubricating people say the same. That responsibility devolves upon the railroad test engineers throughout the country. We have pressure from the purchasing agents who want to do as much business with as many people as possible.



"Another batch of unstable fuel, huh?"

Then we have mechanical requirements. They do not want anything in their diesels that will increase their maintenance cost. Also, we do not want the diesel stalled by failure caused by lubricating oil.

To me that is a real engineering problem. It does not concern the engine builders or the oil refiners so much; but it does concern the railroad as a major engineering problem involving diesel operation on American railroads today.

I do not know how it will be solved. I do not know if this committee can lend any assistance or influence toward even only serious consideration of this problem. If it does that, it will have done a worthwhile service to American railroads.

Diesel Insurance

H. J. VANDEREB, HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY—Our company has, for the last ninety years, specialized in inspection and insurance of all kinds of power-plant apparatus. For the last thirty years the company has dealt with breakdown accidents of diesel and gas engines. It is interesting to follow the trend during those thirty years of the accident frequency as the gradual improvement in design, metallurgy, etc., and the operating practices developed.

In the early thirties there were widely diverging practices in some important design details and cooling-system practices were definitely neglected. Open-type cooling systems where then much used, while, at present, the closed-type cooling system is practically universal in stationary practice. Accident frequency of insured engines in 1930 was one accident for every two engines per year. At present the accident frequency of insured engines is one in approximately twelve engines per year. This is a great improvement.

A considerable factor has been the recommended practices published by the DEMA. However, owing to the inflated cost of replacing and repairing damaged parts, the bill is now three times that of 5 or 6 years ago.

Failures have, in the last twenty years, constituted about 20 per cent of the accidents. In the last two years they have increased to 37.5 per cent. Pistons and liners are down to 25 per cent, lower than ever. Shaft breakage is down to 3.5 per cent. Crank-bolt breakage is also down to 3.5 per cent. Bearing temperatures are much higher now than they were. That, undoubtedly, explains the increase in frequency of bearing failures. The rest is scattered over exhaust valves, gears, governors and other small parts.

Crankcase explosions during the last two years included one mild one and one rather serious one. The only remedy that I can see from our experience is avoidance of providing the ignitor by overheating or improper maintenance of parts that furnish ignition, usually piston seizures or overheated bearings.

"It got a little hot. Is it compensable?"

(In response to a request for a definition of "accident" in insurance terminology, Mr. Vandereb gave the following clarification.)

An accident is defined as the breaking in two or more pieces of certain parts, or the burning out of other parts. For instance, a shaft, big casting or important bolts, like crank bolts, must break into two or more parts. If we prevent a serious accident by finding incipient cracks or fatigue cracks in those parts, there is no claim if the part has to be replaced. The burning out of parts is, of course, a compensable loss—such as a mechanical bearing failure, as distinguished from corrosion. Corrosion is not accidental. It is definitely a process apart from what you might call breakdown. It could figure in a breakdown accident, if there is complete rubbing out of the bearing metal.

Frequently, we have cases where corrosion progresses at a rapid rate and the oil pressure goes down. The man uses good judgment and shuts the engine down when the oil pressure reaches a dangerous point. Then, people are disappointed that they have no recourse for insurance in replacing the bearings. Of course, that is decided on whether there is any rubbing or melting of the metal—the process of mechanical failure.

Pressure Blasting

A tool for production and maintenance work

THE blasting technique—typified in perhaps its crudest sense by sand blasting—is a well accepted and widely used process. It is, in effect, controlled abrasion and as such has application as a specialized machine tool. Utilization of the process is limited only by the flexibility and degree of control of the necessary equipment. The basic advantages of the technique are that it permits certain jobs to be done faster, better and cheaper than by other means, and that there are some jobs unique to the process.

In the mechanical fields, the principal use of such equipment has been for deburring, descaling and general surface cleaning and finishing. Each of these categories covers a wide range of operations and for maximum utility, a machine of this type should have great flexibility. One such machine offering a high degree of this facility is the Cro-Hone Pressure-Blast, a wet blaster built by the Cro-Plate Company of Hartford, Connecticut.

In production work, the special design features of the machine, discussed later, have found application for general deburring of machined parts at a reduction in time and cost. One special application for which there appears to be no substitute for the pressure blasting process is the internal deburring of long holes. American Bosch Corporation, for example, uses the machine to deburr the juncture of long, small diameter, intersecting holes drilled in their larger nozzle holders.

Descaling covers operations ranging from removal of mill and welding scale to scales resulting from heat treatment. A variation of this, pertinent to the maintenance field, is the removal of carbon formation, varnish, and lacquer from engine parts, such as pistons, valves, heads, etc.

Surface cleaning and finishing is an equally broad field. Flexibility of the machine provides finishes varying from actual and appreciable stock removal to polishing in the micro-inch measurement range. It is, therefore, possible to use the equipment for preparation of parts for plating or painting and at the other extreme, breaking the glaze on a cylinder liner and getting a uniform satiny finish. In preparation for maintenance work, parts can be cleaned and rust or other oxides removed.

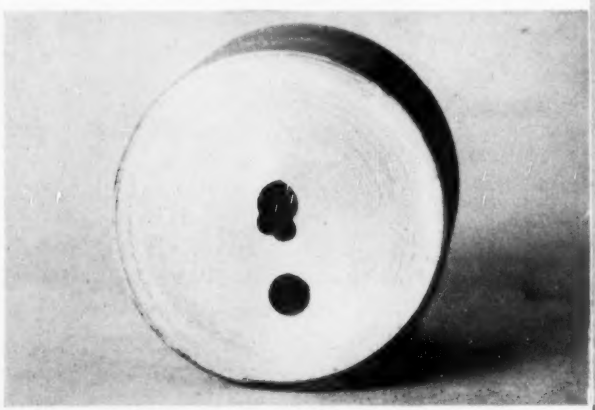
Several models are currently in production, although several specialized units have been built. The most popular unit is floor mounted and has a 30-in. by 30-in. work table. Loading is through a side door. The operator works through arm holes having built-in heavy rubber sleeves. The stainless steel interior is lighted and he has good visibility through a windshield. All controls are knee-actuated, including a windshield water spray with a separate drain.

The principle of wet pressure blasting involves the impingement of abrasive particles, suspended in water, on the work. The ability of a constant mass (here the size of the grit ranges from 45 to 5000 mesh) to do work varies as the square of the velocity ($E = KV^2$) and this fact has been used to advantage in the design of the machine.

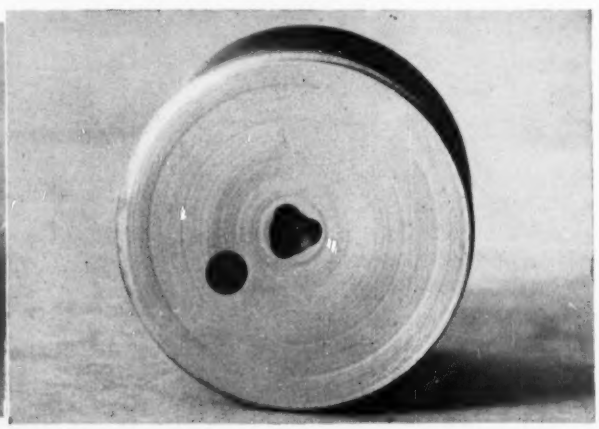
Velocities of 350 to 400 mph. are normally achieved when the slurry, delivered by normal aspiration, is accelerated by the blast air. By pressurizing the hopper containing the slurry to the same pressure as the blast air and delivering it to the gun under this pressure, the maximum velocity of the abrasive particles is about tripled. The rate of doing work is thus greatly increased. The machine is arranged for selective aspirated or pressurized operation.

Flexibility with regards to rate of coverage and finish is also a function of the type and size of the abrasive grain. Standard abrasives from 45 to

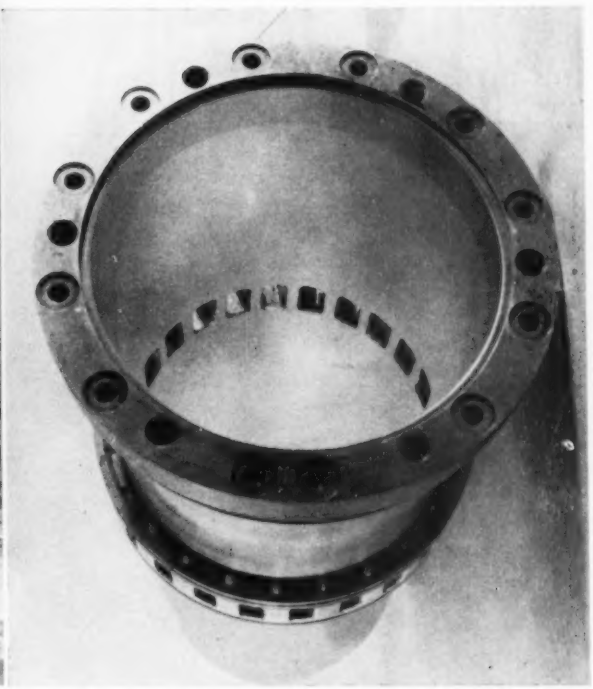
Section through a large nozzle holder at the point of convergence of some small diameter, deep holes. Deburring is ordinarily difficult or impossible.



A similar section through another nozzle holder where pressure blasting was utilized for reburring. High velocity of the abrasives smoothed the juncture.



Knee-actuated controls leave the operator's hands free for the manipulations of the gun and the work.



Lacquers, varnishes, etc., are removed and any glaze broken in liner bore. Port area is also smoothed.

5000 mesh can be used. A 70-lb. charge (35 gal. of slurry) is used in the hopper and air jets agitate the slurry to keep the particles in suspension.

A third variable contributing to flexibility and control is the ability to vary the quantity and speed of the blast air. Normal requirements call for 40 cfm. at 30-90 psi., but this can be varied to suit the job requirements by nozzle changes.

When the work is completed, all that is needed is a thorough cold water rinsing. The abrasive particles are readily removed and there is absolutely no evidence that any remain imbedded in the work. No special skill is needed for effective utilization, but, as in the case of everything else, little tricks and short cuts will be picked up in the course of time.

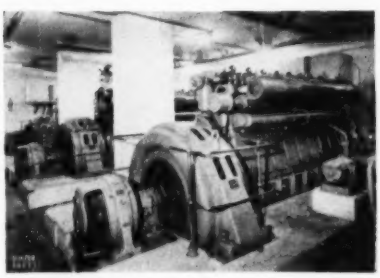
The major uses of such a tool are clear cut, but with some ingenuity, new applications will be found, resulting in greater utility and a saving in time and cost of operations.

French Underground Diesel Power Station

During the last few years the Administrative Branch of the French Postal, Telegraph and Telephone Ministry, responsible for long-distance underground cable connections, with headquarters in Paris, has built and placed in operation an amplifier plant.

In order to insure the operation of the plant under all circumstances, the station was equipped with two indepent plants serving the same purpose. One of these is erected above ground and receives power from the city of Paris supply. The other, an underground installation, safe from air attack, obtains current both from the electric mains and from a power station of its own.

The underground plant consists of three 8-cyl., 4-stroke Sulzer diesel en-



gines of 370 hp. each at 500 rpm. and direct coupled with 2-phase generators of 220 volts at 50 cycles.

All possible precautions were taken to make this underground station safe from outside interference and thus to insure the very maximum of reliability in service. All pipes for the cooling-water of the diesel engines and for the fuel and compressed-air supplies were kept within the subterranean building. The engine cooling water runs in a closed circuit and is recooled in tubular coolers. Water is taken from a special well below the station.

A separate pump is provided for the circulation of the cooling water in each of the diesel engines. The electric motors driving these pumps are direct coupled with the main generators of the corresponding sets, so that the pumps come into service automatically as soon as the diesel engines are started with compressed air.

The foundations of the units are supported by springs with vibration dampeners so as to prevent the transmission of any oscillations to the sensitive amplifying equipment.

DIESEL BRIEFS

New Kingston Built Locomotive

An elaborate celebration marking the introduction of the first Consolidation type of road diesel locomotive was held August 1 at the Kingston plant of the Canadian Locomotive Company. Robert H. Morse, Jr., president of the company, was official host.

The event, which was designated as "Kingston Diesel Day", also commemorated the production of the first road diesel locomotive built in North America by this same company in 1928, also at Kingston.

The Consolidation locomotive displayed was a 3200 hp. road freight type weighing 520,000 pounds. Other models in this line include high speed passenger types and switchers. All Canadian Locomotive Company Consolidation locomotives are powered by Fairbanks, Morse opposed piston diesel engines, of the type widely used in submarines during the war. The company is tooling up at the present time to produce the opposed piston engine in their Kingston plant. Production is expected to start in a few months on the new locomotive.

Transportation Study

United States transportation facilities are the subject of a chart recently released by Dun & Bradstreet, Inc. It shows the changes in carrying capacity and types of equipment for the various types of carriers in the decade between 1940 and 1950. In 1950 the volume of traffic carried exceeded the 1940 level by about 44 per cent. All carriers registered gains in volume, with the railroads getting nearly half of all traffic carried.

Total railroad track mileage has decreased as less profitable branch lines have been eliminated, although total tractive capacity has increased. The most notable shift has been from steam to diesel power which now provides over 1/3 of total engine capacity.

National expenditures for all types of transportation — passenger and freight—were $47 billion in 1950, or one dollar out of every five of the national income.

Industrial Experimentation Conference

The second conference on industrial experimentation sponsored by the Department of Industrial Engineering of Columbia University will be held September 17-21, 1951 on the Columbia campus. This five-day intensive conference is designed to bring to those engaged in industry and research some of the latest developments in modern statistical methodology which are pertinent to the design, analysis, and interpretation of experiments. Emphasis will be placed on the fundamental principles which underlie the statistical design of experimental programs and the practical techniques with which to carry out these designs so as to yield the most fruitful conclusions at the least cost and in the shortest time.

The fee for the conference, including all books and supplies and all lunches and dinners at the Men's Faculty Club, is $150.

Locomotive Maintenance Officers Association Annual Meeting

The Locomotive Maintenance Officers' Association will hold their annual meeting, September 17-19 at the Hotel Sherman in Chicago.

There will be special exhibits, a luncheon, and talks by the various committee chairmen. Some of the topics to be discussed are: "Winterization of Diesel-Electric Locomotives", "How to Create Interest and Train Personnel for Diesel Locomotive Work", "Diesel Truck Maintenance", "Reclamation of Diesel-Electric Locomotive Parts", and "Interior & Exterior Diesel Locomotive Cleaning".

London Engineering, Marine & Welding Exhibit

The Engineering, Marine & Welding Exhibition will be held August 30-September 13, 1951 at Olympia, London. Chief sponsoring organizations include the British Engineers' Association, the Society of Motor Manufacturers and Traders (Marine Section), the British Electrical and Allied Manufacturers Association, the Institute of Welding, and the British Acetylene Association.

The exhibits will cover a wide range of engineering products, many shown in actual operation. Included will be exhibits on industrial and marine engines, auxiliary equipment, scientific instruments and automatic controls, pumps, valves, welding, electrical equipment, research and foundry equipment.

DIESEL BRIEFS

New York State Truck Tax

The New York State Tax Commission has set in motion the machinery for administering the new truck mileage tax by distributing two basic forms—the application for highway use permits and the highway use permit blank. Affected is every vehicle using New York highways which has a maximum gross weight of more than 18,000 lbs, and every vehicle subject to the law must have a highway use permit and plate in order to operate legally on the highways of New York after September 30. The tax applies to interstate as well as intrastate operations in New York, regardless of whether a vehicle is registered in New York or another state. An estimated 150,000 vehicles of 35,000 truck owners are affected.

Truck taxpayers will have to file monthly tax returns, due the 20th of the month for operations in the preceding month. First tax returns, therefore, will be due November 20, covering October operations.

The tax is based on two factors—the maximum gross weight of a vehicle and its mileage in New York State. Rates, graduated according to weight, start at six tenths of one cent per mile for a maximum gross weight of 18,001 to 20,000 lbs., and range up to 2.4 cents per mile for maximum gross weight of more than 62,000 lbs.

Expansion for Texas Distributors

A new half-million dollar building has just been occupied at Dallas, Texas by the Beard and Stone Electric Co., Inc., distributors for American Bosch and Bendix-Scintilla fuel injection systems. The plant is a nerve center for a state-wide distribution business of original equipment for automobiles and trucks.

Included in the new building is a diesel injection department of four rooms, with a total area of 1070 sq. ft. The work shop is central with the diesel office, stock and pump clean-up rooms conveniently located on either side. All injector parts are kept in this department, which includes those for most pumps used in this territory on industrial, farm, and railroad equipment. The department is under the supervision of Richard Giles, who has been with the company since 1929.

Much consideration has been given to future expansion with ample room provided for additional equipment and parts. Bench arrangement in the shop area provides room for small groups of customers' men who visit the shop occasionally for special instructions on their diesel equipment. Accommodations for larger classes is taken care of by an auditorium, also located in the new building.

SAE Meeting

Reports on 12 months of test operation of a new turbine-powered motor truck will highlight the National West Coast Meeting of the Society of Automotive Engineers at Seattle, Washington, August 13, 14 and 15. Fresh data on continued development of new-type military vehicles will also be revealed.

Technical needs of motor trucks in highway carrier service on the West Coast, both in peace time and war time will be discussed. Other topics emphasized will include (1) bus requirements for city transportation, (2) wear difficulties with dual tires, (3) turbosupercharging for high-speed diesels; and (4) probable effect of mobilization on West Coast transportation.

Pipeline Planned

Six major American oil companies have joined to finance and construct a new large-diameter crude oil pipeline system, the Rancho Pipe Line, to extend 477 miles from McGamey, in the Permian basin of West Texas, to Houston and Texas City. It will have an initial delivery capacity of about 209,000 bbl. daily. Cost is estimated at more than $35,000,000 and completion is scheduled late in 1952.

The line will be designed and constructed by Shell Pipe Line Corp. Other participants are Sinclair Pipe Line Co., Pan American Pipe Line Co., Phillips Pipe Line Co., Nantucket Pipe Line Co., and Tidewater Pipe Line Co.

Crankcase Explosion Investigation

*by G. W. Ferguson**

Part II

The first part of this article, presented last month, discussed crankcase explosion reports, composition of the crankcase atmosphere, composition of the white smoke that so often precedes a crankcase explosion, inflamability limits of hydrocarbons, changes in the crankcase atmosphere during primary and secondary explosions, and a description of the apparatus used in the study of this phenomena. This part presents the results and conclusions of the investigations. This work is an important contribution to the general understanding of the subject.

Mechanism of Ignition of an Oil Mist

During the course of tests with the crankcase explosion tube apparatus, moving pictures were made showing the ignition phenomena of a typical additive type paraffinic base oil mist. These pictures showed that upon ignition of an oil mist containing large droplets of oil by a nichrome coil ignitor heated to approximately 1500° F. Small bursts of incendiary particles appeared near the surface of the ignitor, gradually increasing in size until a flame appeared. After the appearance of flame, additional bursts of incendiary particles up to the point where the flame propagated throughout the mixture, were observed. Following general ignition, particles of oil in the after flame showed the incompleteness of combusition in the initial explosion for mixtures containing large droplets of oil.

Minimum ignition temperature of a lean, finely divided oil mist/air mixture using a 2-in. by 1-in. by 0.02-in. nichrome bar as an ignitor, was 1600° F. As in the previous case with large droplets of oil, bursts of incendiary particles were observed up to the time where inflamation occured. However, with the finely divided oil mist, no flames were observed on the ignitor during the ignition lag. The absence of incendiary particles in the after-burning flames, following general ignition, indicates that combustion may be more complete in the finely divided mist than in mixtures containing large droplets.

With richer mixtures where the minimum ignition temperature of the finely divided oil mist/air mixture was below 1500° F, no incendiary particles were obserevd prior to or after general inflammation. Although the ignition lag for this mixture was essentially the same as for mixtures containing large droplets or for lean mixtures of fine particle size, no incendiary particles were observed up to the time of general inflammation. The pictures show that ignition started near the surface of the ignitor and spread progressively throughout the mixture.

Considerable quantities of white smoke (condensed oil vapor) were observed in the explosion tube prior to general ignition. During ignition tests, it was impossible to obtain ignition in the white smoke atmosphere with a heated surface when the oil injection was turned off; however, the condensed mist appeared to propagate a flame once ignition was initiated in the oil mist/air mixture. In enclosed crankcases, where the engine has stopped, it may be possible that an overheated part could produce suf-

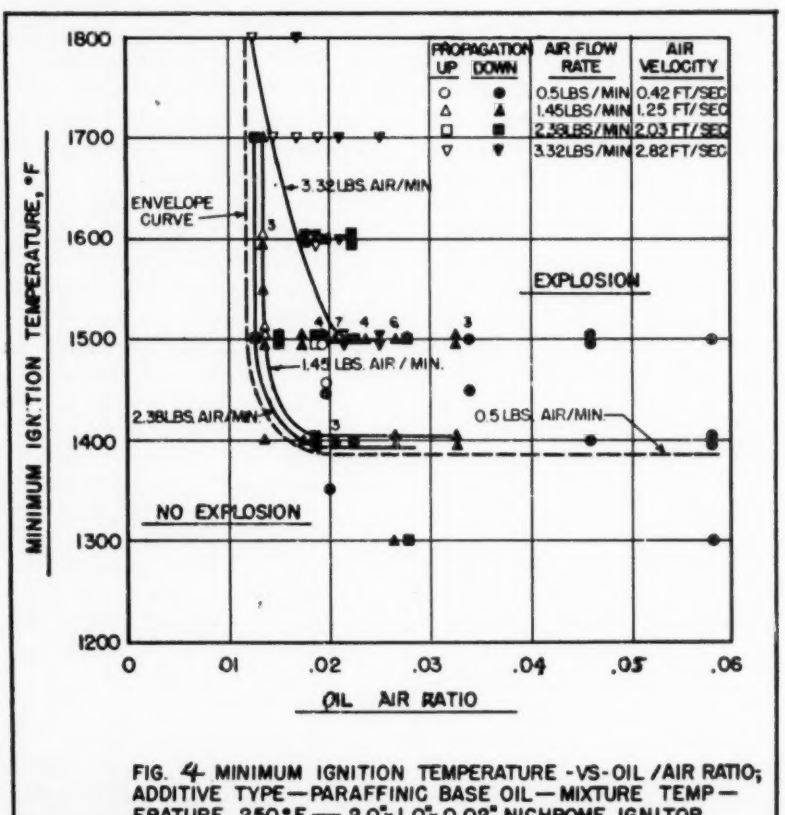


FIG. 4 MINIMUM IGNITION TEMPERATURE -VS- OIL /AIR RATIO; ADDITIVE TYPE—PARAFFINIC BASE OIL—MIXTURE TEMPERATURE 250°F.— 2.0"x 1.0"x 0.02" NICHROME IGNITOR.

*The Texas Company, N. Y. Abstract of a paper presented by the author at the Oil and Gas Power Conference of the American Society of Mechanical Engineers at Dallas, Texas. Collaborators on the paper with Mr. Ferguson were: Messers. Brian Corrigan, of the Texas Co., New York, N. Y.; R. S. Wetmiller and E. M. Johnson of the Texas Co., Beacon, N. Y.

ficient quantities of condensed mist to form an inflammable mixture which would propagate a flame.

The extreme heterogenity of the mixture in the crankcase explosion tube may account for the various phenomena observed in the above-mentioned tests. The bursts of incendiary particles, the appearance of flame on the ignitor, and the presence of condensed oil vapor, before general ignition occurred, indicate that several events simultaneously occurred in the mixture. The mechanism of inflammation in a diesel engine crankcase is undoubtedly similar in many respects to that in the cylinder of a diesel engine. If a volume of the mixture in the vicinity of the ignitor could be completely analyzed prior to ignition, it would possibly contain areas where droplets of oil were in contact with air, vaporized oil and no air, products of thermal decomposition, partial oxidation, and completed combustion. In addition, there would be areas where oil vapor, condensed oil vapor, and/or products of thermal decomposition, partial oxidation, and completed combustion were mixed in varying proportions with air. The incendiary particles indicate regions where a mixture of these components is in an inflammable range. Only after an appreciable time lag does the physical agitation, the vaporization, partial oxidation, and thermal decomposition of the oil particles result in an inflammable mixture which, upon ignition, will give up sufficent energy to the surrounding medium for the flame to propagate throughout the whole mixture by the vaporization, and subsequent ignition of the adjacent oil particles.

As will be seen from the data which follow, there are many variables which affect the temperature at which ignition occurs.

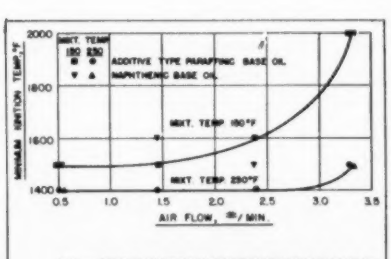


FIG. 6 - EFFECT OF MIXTURE TEMPERATURE AND AIR FLOW ON MINIMUM IGNITION TEMPERATURE AT 0.025 OIL / AIR RATIO

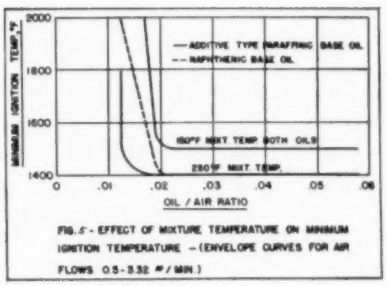


FIG. 5 - EFFECT OF MIXTURE TEMPERATURE ON MINIMUM IGNITION TEMPERATURE — (ENVELOPE CURVES FOR AIR FLOWS 0.5-3.32 #/MIN.)

Minimum Ignition Temperature of Oil Mists

Figure 4 illustrates typical minimum ignition temperature versus oil/air ratio data for an additive type paraffinic base oil at a mixture temperature of 250° F and air flow rates of 0.5, 1.45, 2.38 and 3.32 lb. air/min., respectively. The plotted points represent only the minimum ignition temperatures observed for 97 runs (approximately 400 individual tests) using a 2 by 1 by 0.02 in. nichrome ignitor, from the lower limit of inflammability to the richest mixture which could be obtained with the apparatus. From an oil/air ratio of 0.02 to the maximum obtainable at each air flow, the minimum ignition temperature was found to be 1400° F for air flows 0.5, 1.45, and 2.38 lb. air/min., and 1500° F for 3.32 lb. air/min. At oil/air ratios approaching the lean limit, the minimum ignition temperatures increased very rapidly. For oil/air ratios approaching the upper or rich limit, the same increase in minimum ignition temperature would be expected; however, due to limitations in equipment, this could not be verified. Except at lean oil/air ratios, a majority of the points indicated a minimum ignition temperature of 1500° F; however, at the lower air flows, enough points were obtained at 1400° F to establish this value as the probably true minimum ignition temperature in these cases. An envelope curve has been shown to define the areas for explosion and no explosion at all conditions employed.

These data emphasize the necessity of conducting many tests to establish minimum ignition temperatures within close limits. On other oils where fewer tests were conducted, it is probable that the minimum ignition temperatures reported may be as much as 100° F higher than the true value.

Effect of Mixture Temperature on Minimum Ignition Temperature

To illustrate the effect of mixture temperature on minimum ignition temperature, envelope curves are shown for a high flash point additive type paraffinic base oil and a low flash point naphthenic base oil at mixture temperatures of 150° F and 250° F in Figure 5. These data indicate that, on an overall basis, no appreciable difference was found in minimum ignition temperature for the two oils at the same mixture temperature. A decrease of 100° F in mixture temperature produced a corresponding increase in minimum ignition temperature for both oils from an oil/air ratio of 0.02 to 0.058 lb. oil/ lb. air, and increased the lower limit of inflammability from 0.013 to 0.017 lb. oil/ lb. air.

Effect of Air Flow on Minimum Ignition Temperature

Figure 6 shows the effect of mixture temperature and air flow on minimum ignition temperature for the same oils discussed above at an oil/air ratio of 0.025 lb. oil/ lb. air. As in Figure 5, the minimum ignition temperature for the two oils was essentially the same. For air flows of 0.5 and 1.45 lb. air/min., a decrease in mixture temperature from 250° F to 150° F raised the minimum ignition temperature of the two oils from 1400° F to 1500° F. Above 1.45 lb. air/min., the

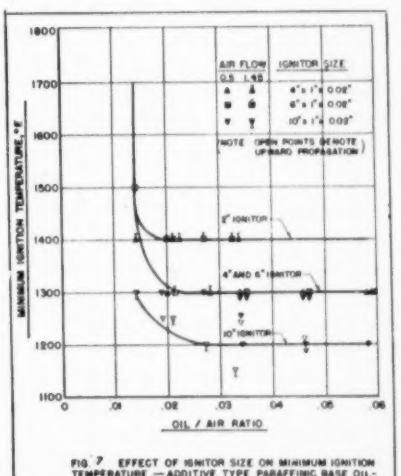


FIG. 7 EFFECT OF IGNITOR SIZE ON MINIMUM IGNITION TEMPERATURE — ADDITIVE TYPE PARAFFINIC BASE OIL-MIXTURE TEMP. 250°F — ENVELOPE CURVES FOR AIR FLOWS 0.5 — 1.45 #/MIN.

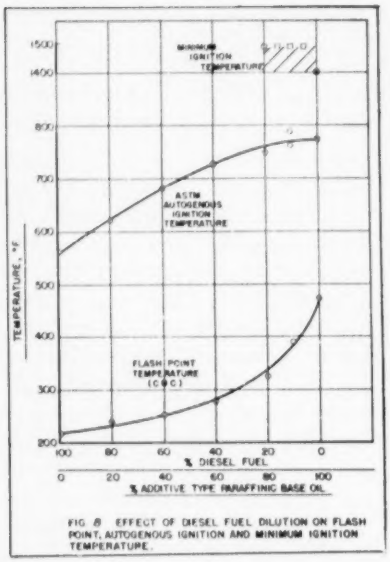


FIG. 8 EFFECT OF DIESEL FUEL DILUTION ON FLASH POINT, AUTOGENOUS IGNITION AND MINIMUM IGNITION TEMPERATURE.

100° F reduction in mixture temperature increased the minimum ignition temperature from 1500° F to 2000° F. The effect of air flow on minimum ignition temperature of the two oils was considerably greater at 150° F mixture temperature than at 250° F.

Effect of Ignitor Size on Minimum Ignition Temperature

The minimum ignition temperature vs. oil/air ratio envelopes, illustrated in Figure 7, indicate a decrease in minimum ignition temperature from 1400° F to 1300° F when the length of the ignitor was increased from 2 in. to 4 and 6 in. With a 10-in. ignitor, the minimum ignition temperature was reduced to 1200° F. Due to limited transformer capacity, the data for the 4-, 6- and 10-in. ignitors were obtained at air flow rates of 0.5 to 1.45 lb. air/min.

The data shown in Figures 5, 6 and 7 suggest that, with additional increases in mixture temperature and ignitor size, the minimum ignition temperature should approach the autogenous ignition temperature of the oil; that is, as the conditions for the transfer of heat from the point of ignition become less favorable, the mixture will ignite at a lower ignitor temperature. This same reasoning may be employed to explain the large differences between the minimum ignition temperature obtained in the explosion tube and ASTM autogenous ignition temperatures. For example, additive type paraffinic base oil showed 1400° F in the tube and only 785° by the ASTM test.

Minimum Ignition Temperature of Various Oils

In order to determine if there were any appreciable differences in minimum ignition temperatures of a wide range of lubricating oils, tests were run using a 2 by 1 by 9.02 in. nichrome ignitor at an oil/air ratio of 0.027 lb oil/ lb. air, an air flow of 1.45 lb. air/min., and 250° F mixture temperature. With the exception of one oil containing tetraethyl lead, all of the wide variety of samples investigated showed minimum ignition temperatures of 1400-1500° F. These values are considered to be checks as pointed out previously.

Effect of Fuel Dilution on Ignition Temperature

Since fuel dilution in diesel engines is a frequent occurrence, it is in order to consider its potential danger and effect on ignition temperature. Test data has been plotted in Figure 8 to show the effect of fuel dilution on flash point, autogenous ingition, and minimum ignition temperatures. From 0 to 20 per cent dilution, a sharp drop in flash point temperature (475° F to 325° F) was accompanied by a gradual decrease in autogenous ignition temperature (775° F to 750° F), while the minimum ignition temperature remained essentially the same. With additional dilution, the flash point and autogenous ignition temperatures decreased gradually to values of 215° F and 590° F, respectively, for 100 per cent diesel fuel. Since dilution in excess of 20 per cent is outside the range of practicability, it is indicated that normal fuel dilution will have no significant effect on crankcase explosions.

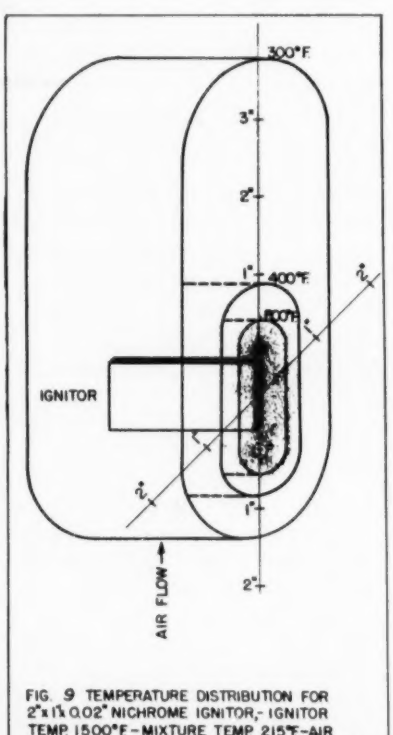


FIG. 9 TEMPERATURE DISTRIBUTION FOR 2"x1"x 0.02" NICHROME IGNITOR,- IGNITOR TEMP. 1500°F - MIXTURE TEMP. 215°F - AIR FLOW 0.5 #/MIN. - AIR VELOCITY 0.427FT/SEC

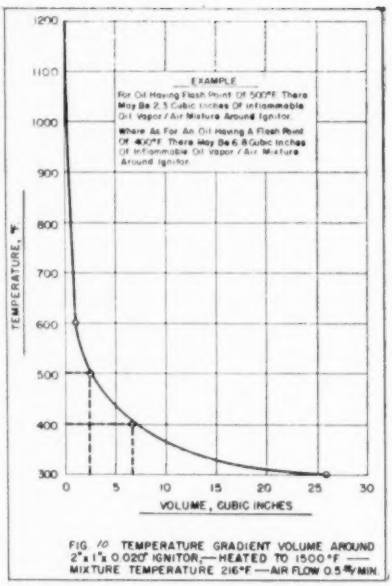


FIG. 10 TEMPERATURE GRADIENT VOLUME AROUND 2"x 1"x 0.020" IGNITOR;— HEATED TO 1500°F — MIXTURE TEMPERATURE 216°F — AIR FLOW 0.5 #/MIN.

Temperature Distribution Around Ignitor

During the course of the work reported herein, horizontal and vertical temperature traverses were made on a 2 by 1 by 0.02 in.-nichrome ignitor heated to 1500° F to estimate the temperature distribution around the ignitor during the ignition tests previously described. From the temperatures measured at an air flow of 0.5 lb. air/min. (0.427 ft./sec.) and an air temperature at the edge of the tube of 215° F, the temperature distribution envelope, illustrated in Figure 9, was drawn. As illustrated, the temperature decreased approximately 1000°

F ½ in. away from the ignitor on all sides. Due to convection currents and air flow, the 300° F temperature point was found to be approximately 4 in. above the top edge of the ignitor as compared to approximately 1½ in. to the side. From this figure, the isotherm temperatures were plotted in Figure 10 against the volumes enclosed by various isotherms. This curve may be employed to estimate the volume of inflammable oil vapor in the vicinity of the heated ignitor. Example: For an oil having a flash point of 500° F, there may be 2.3 cubic inches of inflammable oil vapor/air mixture around the ignitor; whereas, for an oil having a flash point of 400° F there may be 6.8 cubic inches of inflammable oil vapor/air mixture. As mentioned earlier, if the flame velocity is greater in an oil vapor/air mixture than in an oil mist/air mixture, the intensity of an explosion with the 400° F flash point temperature oil would possibly be greater than that for the 500° F flash oil. As also mentioned earlier, no differences in minimum ignition temperature could be detected between oils such as those mentioned above.

Summary

In the foregoing report, the crankcase atmosphere of a normally operating diesel engine burning liquid fuel was not found to be composed of explosive gases or an appreciable amount of oil vapor, but of a potentially inflammable mixture of air charged with particles of oil sprayed and thrown from the engine's moving parts. With oils employed for diesel lubrication, only negligible quantities of oil vapor are present until the heat evolved by some overheated part or flame vaporizes sufficient quantities of oil particles to form, locally, an inflammable mixture of oil vapor and air.

The crankcase atmosphere of dual-fuel engines examined to date do not appear to be significantly different from engines burning 100 per cent liquid fuel. Although up to 3.5 per cent (by volume) inflammable gases were found in these engines, the concentration was too low to be in the inflammable range. However, it should be realized that increased blow-by of natural gas due to increased ring wear and piston clearances could possibly result in inflammable gas/air mixture in addition to the potentially inflammable oil mist/air mixture.

The formation of condensed oil mist by the vaporization of oil impinging on an overheated surface may substantially contribute to the formation of an inflammable mixture in the crankcase when the engine is shut down.

On a weight basis, the lower limit of inflammability of a finely divided oil mist would be expected to be essentially the same as for the oil in the form of a vapor. It was also indicated that the lower limit of inflammability of lubricating oil mist compared very well with that of vapors of lower flash point hydrocarbons.

Lowering the per cent oxygen concentration in a diesel engine crankcase should result in narrowing the inflammability limits of an oil mist/air mixture or an oil mist-natural gas/air mixture until a minimum oxygen concentration is reached (approximately 12 per cent), below which flame will not propagate.

The occurrence of an overheated part in the diesel engine crankcase may not necessarily result in a crankcase explosion. If there is sufficient time lag before enough energy can be transferred from an overheated part to the oil mist/air or oil mist-natural gas/air mixture, then the oxygen concentration may be reduced below the minimum required for flame propagation.

Because of the extreme heterogenity of the mixture in a crankcase, the mechanism of ignition is undoubtedly a very complicated process. With a surface heated to 1400-1500° F in an oil mist/air mixture, simulating that in a diesel crankcase, there is an appreciable delay before general ignition occurs during which several events are simultaneously occurring. Only after this time lag does the physical agitation, vaporization, partial oxidation, and thermal decomposition of the oil particles in the presence of air result in an inflammable mixture, which upon ignition, will give up sufficient energy to the surrounding mixture for the flame to propagate throughout the whole mixture.

Over a wide range of oil/air ratios, the minimum ignition temperatures were lowered by decreasing the air flow and by increasing the mixture temperature and ignitor size. As the conditions for the transfer of heat from the point of ignition become less favorable, the mixture will ignite at a lower ignitor temperature. Conversely, it is indicated that improving the conditions for the transfer of heat from the point of ignition will reduce the tendency for the occurrence of crankcase explosions.

From the data obtained with the crankcase explosion tube, no significant differences were found in the minimum ignition temperatures of oils commonly employed for diesel lubrication, nor was there any appreciable lowering of the minimum ignition temperature when the oil was diluted with up to 20 per cent diesel fuel.

In view of these observations, it would appear that, as long as inflammable lubricants are employed for diesel lubrication, a potentially dangerous situation exists. At the present stage of the art, apparently little can be done from a lubricating oil or fuel standpoint to prevent diesel engine crankcase explosions. It is suggested that the problem might best be attacked by further critical studies of maintenance procedures and continued refinements in engine design.

Table VII

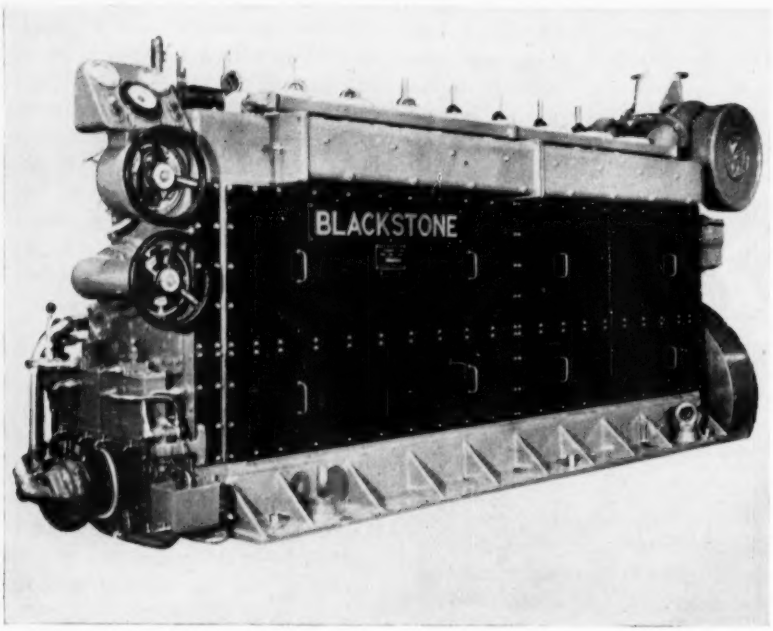
SUMMARY OF PHYSICAL PROPERTIES AND IGNITION TEMPERATURES OF VARIOUS OILS TESTED

	FLASH (COC) °F.	VIS. SU. AT 210 °F SECONDS	AUTOGENOUS IGNITION TEMP., °F.	IGNITION TEMP., °F.
PARAFFINIC BASE OILS				
IRL-40-709	500	60.5	745	1400
IRL-40-5706	505	63.0	765	1500
IRL-0-7101	500	55.0	760	1500
IRL-0-4504	505	60.5	795	1500
IRL-40-5407	410	52.6	765	1400
IRL-0-4513	410	50.3	805	1400
IRL-8-4212	410	50.0	810	1500
PARAFFINIC BASE OILS				
IRL-0-5008	410	45.3	750	1500
IRL-7-10169	470	54.9	795	1400
IRL-0-850	490	57.9	790	1400
IRL-0-7707	500	72.5	795	1500
IRL-7-1909	500	65.2	795	1500
ADDITIVE TYPE PARAFFINIC BASE OILS				
IRL-0-4041	450	50.0	710	1500
PA-21377	430	55.9	760	1500
IRL-0-4307	440	60.0	780	1500
IRL-0-5205	460	60.0	790	1500
IRL-0-5104	460	60.5	810	1500
IRL-0-4475	455	54.0	795	1500
IRL-40-2425	475	61.4	795	1400
IRL-40-2425, 10%L. DIST./AL.	465	61.4	795	1500
ADDITIVE TYPE PARAFFINIC BASE OIL - DIESEL FUEL				
IRL-40-2425 95	PA-21550	400	-	780	1500
IRL-40-2425 10%	PA-21550	390	-	750	1500
IRL-40-2425 15%	PA-21550	390	-	705	1500
IRL-40-2425 20%	PA-21550	380	-	730	1500
DIESEL FUEL					
PA-21550	205	-	540	-

(1) VOLUME RATIO OF VAPORIZABLE FUEL TO AIR FOR LEAN LIMIT OF FLAME. (2) % BY VOLUME OF VAPORIZABLE FUEL IN AIR. (3) STOICHIOMETRIC, OR CHEMICALLY CORRECT, FUEL/AIR RATIO = 0.0269, AIR FLOW 1.45 LB./MIN.

Lister-Blackstone's

EV Series Diesel Engines



Marine version of the new Lister-Blackstone EV Series diesel engine. This particular engine is an 8-cyl., turbocharged unit rated 60 hp. per cyl. at 600 rpm.

INTERESTING DESIGN and operational features are found in the new EV series of 4-cycle diesel engines offered by Lister-Blackstone, Inc. These engines are available in a power range extending from 90 hp. to 480 hp. in stationary or marine auxiliary service.

Conservatively rated 45 hp. per cyl. at 600 rpm., the normally aspirated EV engines are available in from 2 to 6-cyl. and in 8-cyl. models. Turbocharged models, developing 60 hp. per cyl. at the same speed, are offered in 4-, 6-, and 8-cyl. sizes. All models of the EV line have bore and stroke dimensions of 8¾ by 11½ in.

General Construction—Structural Parts

The engine bed is of rigid box-section design, reinforced transversely by cross-braced webs which support the main bearings. A flat, webbed plate extending the length of the crankcase provides a wide mounting surface, permitting optimum weight distribution. The engine frame, of cast iron, forms with the engine bed an exceptionally rigid girder-type structure.

Removable, wet-type cylinder liners are manufactured from centrifugally-cast iron and treated by the Listard process of chrome hardening.

Cylinder-heads, of high-grade cast nickel iron, house the inlet, exhaust and air-starting valves, and the fuel injector. Fitting into the cooling water circuit, the design of the cylinder-head provides generous cooling water circulation to the fuel injector tube, valve guides and seats. Eight studs evenly placed around the bore, anchor the head securely to the cylinder jacket.

General Construction—Working Parts

Crankshafts are manufactured from a solid forging of nickel steel, heat treated to give a tensile strength of 80,000 to 100,000 psi. Crankpins and journals are ground and the whole shaft carefully balanced. Passages drilled through the webs feed oil to the connecting rod large-end bearings. The flywheel end of the crankshaft is flanged to form a half coupling to which the flywheel is bolted. The bolts extend through the flywheel to take the half coupling of the driven unit.

The connecting rods are H-section stampings of heat-treated steel. Large-end bearings are of the precision type, steel-backed and babbitt-lined, fitted with four holding bolts. Wristpin bearings are of chill cast phosphor bronze. The rods are drilled to carry oil from lower bearings to wristpin bushings.

Pistons are of closed grained cast iron, shaped with a toroidal cavity in the head that materially improves combustion. Pistons are fitted with three compression rings and two scraper rings, one above and one below the wristpin. The wristpin is ground from hardened steel, fully floating but securely retained.

Pistons and connecting rods can be withdrawn from below in a matter of ten minutes for each operation, simplifying routine inspection and overhaul.

The camshaft, turning in phosphor bronze bearings, is gear driven from the flywheel end of the crankshaft. Individual cast iron tappet blocks are attached to the cylinder housing and each houses the air starter tappet, fuel pump tappet, and the inlet and exhaust valve tappets for each cylinder. Tappets are fitted with hardened steel rollers meeting the cams, also of hardened steel, on the shaft.

Fuel System

A four-weight high-speed centrifugal governor, gear-driven from the flywheel end of the shaft, regulates the delivery of fuel from the pumps and maintains engine speed within 2½ per cent of normal. The governor turns

on ball bearings, all moving parts being totally enclosed and pressure lubricated from the engine's forced feed system .

Separate fuel pumps are standard solid-injection Bosch-type for each cylinder and are mounted on the tappet blocks. High pressure tubing between pumps and nozzles is of short and equal length and the entire system lends itself to very precise control of the fuel injection process.

Injection-nozzles are of the differential spring-loaded, needle-valve type, one fitted in each cylinder head. Injection pressure in these nozzles is adjustable allowing good operation with fuels of different weights. A water-cooled bronze sleeve in the cylinder head accepts the injector, insures maximum heat dissipation during operation.

Lubrication System

The EV and EVS stationary engines utilize a wet sump system with force feed by a gear pump. Oil moves from main bearings to connecting rod bearings and through drilled passage to the wristpin bushings. A by-pass valve prevents lubricating oil pressure from exceeding a predetermined maximum and surplus oil is discharged back to the lube-oil sump, without passing through the filter. A lube oil gauge is provided to indicate pressure at engine bearings.

A semi-rotary pump is mounted on the engine to supply oil to all bearings, etc., and generally prime the system before starting the engine.

Cooling System

All engines in the EV series are furnished equipped for indirect cooling with the primary circuit completely engine-mounted, including pumps, valves, heat exchanger, header tank, etc. Two centrifugal pumps are mounted on the forward end of the engine, one to move fresh water through the heat exchanger, the other to pump raw water through the heat exchanger thence to discharge. Separate heat exchangers are supplied for cooling water and lubricating oil.

All cylinders are maintained at equal temperatures through the use of regulating valves at each outlet.

Starting System

An engine-mounted air compressor relieves the power user of providing an independent source for starting air. Compressors may be engaged as required through use of a clutch and furnish air at 300 psi. to the receiver. EV engines require a normal starting pressure of 250 psi., but will turn on 100 psi.

Controls and Instruments

Starting is effected by turning a small handwheel in clockwise direction which action opens the air valves admitting starting air to the cylinders. After the engine has gathered rotative speed, further movement of the handwheel shuts off the starting air and admits fuel to all cylinders. Continued turning of the wheel shuts off the fuel and stops the engine.

Instruments furnished as standard equipment include an oil-pressure gauge, water-pressure gauge, governor-load indicator, tachometer and recording hour meter. In addition, all

More scrap means more steel
turn yours in today!

engines of the EV series are equipped with automatic shut-offs actuated when engine speed exceeds safe limits or if lubricating oil pressure drops below a predetermined level.

Thermometers at the jacket water outlet of each cylinder indicate cooling water temperature leaving each cylinder. Temperatures may be equalized by use of regulating valves at each outlet. Exhaust pyromteters fitted to each exhaust port indicates temperature of exhaust gases leaving each cylinder, a practical measure of operating efficiency.

Turbocharging

The turbo blower unit consists of a single-stage axial flow exhaust gas turbine driving a centrifugal air compressor which steps up air pressure at the inlet valves by 5 psi. The best available heat and corrosion-resistant material is used in the construction of the turbine wheel and turbine inlet and outlet casings. The bladed turbine wheel is mounted on one end of a steel shaft which carries the centrifugal air impeller at the other.

The air impeller, an aluminum alloy forging, is of the single entry type with radial vanes fitted with special air seals so arranged to reduce axial thrust factors to a minimum.

Turbine shaft bearings are water-cooled and a carefully designed vent in the air impeller seal directs cooling air to the rotor shaft and against the rear face of the turbine disc. The rotor shaft is carried in resiliently mounted bearings, one centering the shaft and the other compensating for thermal expansion. Each bearing is lubricated separately by an individual pump and air-pressurized oil seals prevent any lubricating oil from passing to the inside of the turbine casing.

Turbocharging permits an increase of bmep. from 86.1 psi. to 115 psi. sufficient to take one-third more horsepower from each cylinder without exceeding safe maximum pressures or temperatures. Actually, the accelerated scavenging action has a marked cooling effect on the exhaust valves. Turbocharging also serves to reduce the extremes in pressure variations that affect the turning moment, hence turbocharged diesels are generally smoother running than normally-aspirated ones.

Stationary Service

Engine weight is evenly distributed and each unit area of the mounting flange supports approximately the same weight. The design incorporates an unusually high degree of balance. Consequently, operation is unusually smooth, vibrationless and quiet. The noise of operation is further reduced by the totally-enclosed design.

Close governor control of engine speed recommends the EV series for constant load generating service or other fixed power requirements. Yet by a simple hand control, engine speed can be adjusted through a fairly wide range, including safe intermittent overloads up to 10 per cent, to meet varying power demands.

Technical and cost data for the controversy of

LPG Engines Versus Diesels

*by Leonard Raymond**

Last month we presented some background information abstracted from the author's paper, "Liquified Petroleum Gas as a Fuel for Automotive Vehicles", which he gave at the National Fuels and Lubricants Meeting of the Society of Automotive Engineers. This background material was given to pave the way for future discussions of various phases of this important subject. The subject for discussion now is also admirably covered in this same paper and so it was decided to present further abstractions from this source.

Vehicle equipment for LPG use will be described in general before discussing specific products. A schematic drawing of the LPG fuel system from the tank to the manifold is shown in the accompanying diagram. The LPG vehicle tank, where it is used in a motor fuel application, is specified in NBFU Pamphlet No. 58 as having a minimum design working pressure of 250 lbs. for gases with vapor pressure between 175 and 200 psig. at 100° F. similar to the requirement for storage tanks.

The tanks or containers must be located in such a manner as to minimize the possibility of mechanical injury. The clearance must never be less than the minimum road clearance under maximum load, and fastenings must be designed with a factor of safety of four. The tank must be equipped with proper valves and connections, having a rated working pressure of 250 psig. minimum and the piping from the tank to the first stage regulator must be non-ferrous.

The maximum size of a single vehicle tank is 300 gal. water capacity. The fuel tank has to be cylindrical and will be at least 20 per cent larger than the gasoline tank to achieve the same cruising range, due to the outage, or vapor space, volume. It may be a little difficult to accommodate a tank of the required dimensions in some conversions.

A tank which has had wide automotive use is the Parkhill-Wade safety tank, which allows 23 per cent for outage. Pamphlet No. 58 specifies a minimum of 20.2 per cent. This type of tank shown in cross-section is actually two tanks in one, consisting of an inner vapor tank and a surrounding liquid tank. It virtually eliminates all possibility of the dangers of a liquid-full tank. This company has also developed a safety hose nozzle and tank filler valve which, acting together, shuts off the outage or vapor tank during filling.

The converter is a combination pressure regulator and vaporizer, two-stage pressure reduction being used in many cases, with a jacket water-heated exchanger as a fuel vaporizer between the two stages. No fuel pump is required because of the positive tank pressure.

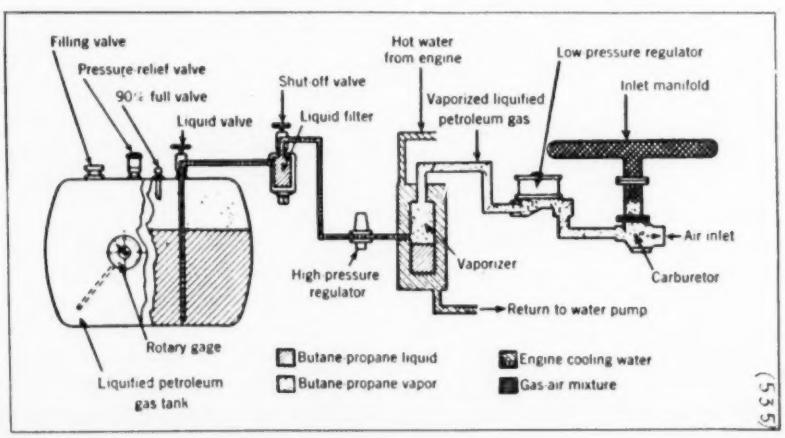
The gas carburetor differs from the gasoline unit in that the propane is supplied as a gas or vapor, mixing with the air taking place in the gas phase. A cold manifold is recommended to improve volumetric efficiency, because no need exists for vaporization of liquid fuel in the LPG manifold.

A higher compression ratio engine is permissible because of the high octane number (above 100) of propane and is also desirable as a means of compensating for the lower heat content or energy per gallon of propane compared to gasoline. It has been said that the use of propane in automotive applications would not be practical without the high octane number and the engine equipped to utilize the high anti-knock quality.

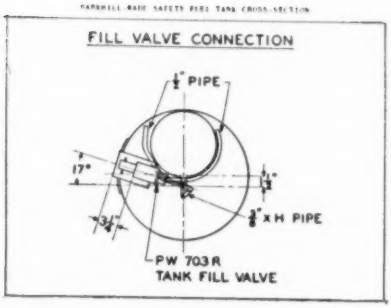
Cold spark plugs are desirable for longer plug life and better over-all performance and are feasible because of the nature of the fuel compared to gasoline.

The heart of the propane or LPG fuel system is the converter and carburetor.

SCHEMATIC ARRANGEMENT OF TANK, CONVERTOR AND CARBURETOR



*Socony-Vacuum Laboratories (A Division of Socony-Vacuum Oil Co., Inc.). Research and Development Department.



A typical regulator unit (Ensign Model S), which is a combined vaporizer and pressure reducing device, together with the assembly of the unit to the carburetor is shown. The regulating unit housing (1) a primary or high pressure diaphragm reducing valve which reduces the pressure of the liquid fuel from the tank pressure of up to 175 lbs. to a regulator pressure of 4 to 10 lbs., (2) a heat exchanger in which the fuel is completely vaporized; this consists of a coil through which the propane passes and which is placed within a chamber through which hot water from the engine is circulated, and (3) a low pressure diaphragm reducing and regulating valve which drops the vaporized fuel pressure from 4 to 10 lbs. to slightly below atmospheric pressure (minus ¼ in. water). This last stage is a very important one, since control of this subatmospheric pressure is essential to the proper metering of the fuel to the carburetor.

In addition, reasonably good control of the jacket water temperature circulating through the vaporizer is desirable since the weight of propane for a given pressure will vary with temperature of the gas which in turn will affect the quantity of propane metered to the carburetor and the air-fuel ratio.

Normal jacket temperatures used with gasoline engines are recommended for the LPG application. Use of heat in the vaporizer also is required to prevent freezing of the high pressure valve and surrounding parts due to rapid expansion of the gases through the reducing valve.

With reference to some of the other parts and connections, balance line (3) from the carburetor air horn to the backside of the main low pressure diaphragm compensates for changes in carburetor air cleaner performance and other air entrance losses by reducing gas flow in accordance with reduced air flow, thus avoiding over-rich mixtures. Idle line (4) is connected to the carburetor at a point above the carburetor throttle and is the principal supply of fuel during idling. Line (8) is the water outlet to the inlet side of the engine pump, while line (13) is the hot water inlet from the engine water jacket to the vaporizer.

The gas is drawn into the carburetor by engine suction, the carburetor and final pressure regulator preferably being coordinated in design so as to produce control of air-fuel ratios over a range of operating conditions. In the Ensign design, a venturi similar to gasoline carburetors and a gas nozzle are used to mix the air and fuel, the load being controlled by the throttle setting. A main load adjusting screw controls the flow of gas to the venturi nozzle. A vacuum-actuated diaphragm operating on a secondary gas passage works as an economizer to reduce the fuel flow under part throttle conditions to give leaner air-fuel ratios. An air-fuel ratio of 12.8 to 13.4 is recommended for full load and between 14 to 14.5 for part load. Starting is facilitated by a special choke arrangement for both the air and gas by means of which a slightly richer mixture is supplied by a small and separate set of gas and air orifices in the carburetor and is automatically fed to the engine when the choke is closed.

In addition to the straight LPG carburetor, combination LPG and gasoline units are available which include a gasoline float and float chamber and separate adjustments for gasoline idling and load.

Engine Operation On LPG

In dealing with the engineering aspects of engine operation on LPG or propane some factual data will be presented first, followed by some of the field experiences with LPG. The first phase of this section will follow a stepwise conversion of the engine, starting with the installation of the LPG converter and carburetor without other change.

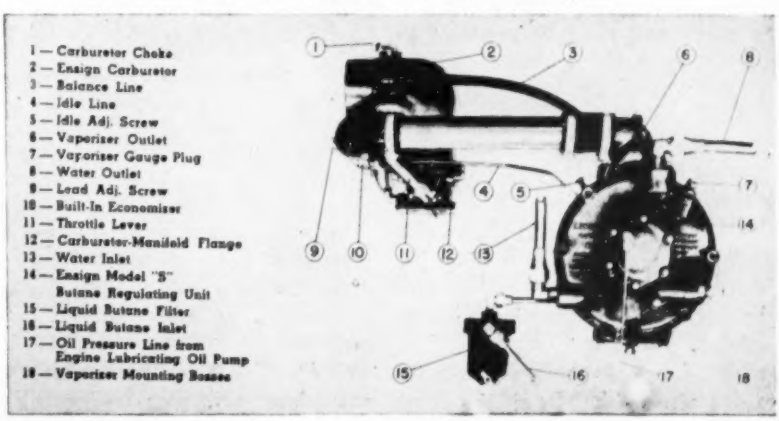
Theoretically, the heat values of chemically correct air-fuel mixtures of propane, butane and gasoline respectively in a gaseous state at atmospheric pressure and temperature are essentially the same, being as follows at 41.7 psia. and 77° F, considering octane (for gasoline) as 100:

Propane 98
Butane 99
Octane (Gasoline) 100

Therefore, at a given compression ratio, disregarding all other factors, the same output from the three fuels would be expected. However, since gasoline enters the engine induction system as a liquid, its vaporization after mixing with the air results in a drop in the temperature of the air-fuel mixture of approximately 50° F. Since propane is vaporized before admixture with air, this drop in temperature does not occur. In addition, the propane gas tends to displace some of the air in the manifold and the over-all effect is a loss in volumetric efficiency and power output which may amount to 5 per cent.

The replacement of the standard

Ensign model S regulator and carburetor assembly.


1 — Carburetor Choke
2 — Ensign Carburetor
3 — Balance Line
4 — Idle Line
5 — Idle Adj. Screw
6 — Vaporizer Outlet
7 — Vaporizer Gauge Plug
8 — Water Outlet
9 — Load Adj. Screw
10 — Built-In Economizer
11 — Throttle Lever
12 — Carburetor-Manifold Flange
13 — Water Inlet
14 — Ensign Model "S" Butane Regulating Unit
15 — Liquid Butane Filter
16 — Liquid Butane Inlet
17 — Oil Pressure Line from Engine Lubricating Oil Pump
18 — Vaporizer Mounting Bosses

gasoline manifold and its hot spot with a cold manifold, protected from heat transmission from the exhaust manifold, will recover a considerable part of the loss in volumetric efficiency. In some engines, such as the Fageol and Hall-Scott in which the intake and exhaust manifolds are on opposite sides of the block, volumetric efficiency has been said to be slightly greater with propane. It is probable also that the better distribution of propane compared to gasoline and the more uniform air-fuel mixtures reach-

Engine Model	Displacement cu. in.	Compression Ratio Gasoline	Compression Ratio Butane	Max. Torque lb.-ft., Gasoline	Max. Torque lb.-ft., Butane	Hp. at Governed Speed Gasoline	Hp. at Governed Speed Butane
670	668	6.85	7	660	696	245	256
480	936	6.7	7	800	815	275	302
400	1090	6.7	7	940	970	295	323

ing each cylinder would tend to improve the power output.

Propane and butane, with their higher octane numbers than current regular grade gasoline, make knock-free operation at higher compression ratios possible, with resultant increase in power output. As an example, the comparisons of Hall-Scott engines based on tests conducted on wartime motor gasoline of 73 octane number and on butane are given in the above table.

It should be noted that this comparison is based on butane. If the higher compression ratios possible with propane or butane were used, the increase in power output should be even greater. It should be pointed out also that ACF-Brill is aiming at compression ratios considerably higher than 7:1 in their current propane and butane engines, a value of 8½-9:1 being indicated. Again, the more uniform cylinder to cylinder distribution of propane-air mixtures compared to gasoline probably contributes to the increased power output.

Similar data are not available to the writer on the Fageol engine, but it would be expected that the change in compression ratio from 7.3 on gasoline to 9.5 on propane in the current engine would produce a considerable increase in power output in line with the compression pressure at the higher ratio.

The change in compression ratio can be accomplished by either change in cylinder head or pistons. In some cases, the increased power output and torque is greater than the capacity of the transmission system to the rear wheels. One manufacturer intends to retain the economy advantages of the higher compression ratio, but to reduce the displacement in order to stay within the torque limits of the warranties on the drive line units.

Not all engines are inherently capable of being changed to higher compression ratios. Difficulty with blown head gaskets, apparently due to the spacing of the head bolts, and cracked cylinder blocks, which may or may not have been associated with the higher compression ratios, have been encountered on one make of engine. Another manufacturer, has cautioned against any attempt to appreciably raise the compression ratio on his engine because of the additional loads placed on the understructure of the engine.

While the stresses are obviously greater at the higher ratios, it would be expected that the heavy duty engines generally would be much freer from mechanical problems than the higher speed, lower bmep power plants. As an example, the Fageol engine used by Twin Coach, according to the manufacturer, has been designed for operation at compression ratios as high as 14:1, so that good mechanical durability should be anticipated.

In increasing the compression ratio, an extra load is placed on the ignition system due to the higher compression pressures and other factors. Based on

	Explosive Limits, % Volume in Air	
	Lower	Upper
Propane	2.37	9.5
n-Butane	1.6	9.5
Gasoline	1.3	6

our own experience with engines of up to 12:1 compression ratio, 12-volt systems generally used in bus equipment are considered necessary to avoid misfiring at the higher loads. In addition, preignition due to hot electrodes becomes more of a problem at the higher compression pressures and temperatures and the coldest possible plug is desirable. This is practicable with propane since spark plug fouling is reduced due to a minimum of fuel deposits.

With regard to spark timing, although the basic flame velocity under laminar flow conditions for propane should not differ greatly from that of gasoline, it has been stated that velocity of burning in the engine is somewhat slower and the engine manufacturers have found that a somewhat greater spark advance of as much as 5-10° is preferred. This apparently is at variance with some foreign experience in which the difference in max-

Fuel	Energy Content Btu/Gal., Gross	% (Gasoline = 100)
Propane	91,500	73
Gasoline, 60° API	125,000	100
Diesel Fuel, 37° API	137,000	110

imum power timing was relatively slight and in the reverse direction.

In connection with the carburetor, it has been said that LPG has a narrower range of burning than gasoline. However, the available data do not bear this out if we consider limits of inflammability as shown in the accompanying table.

This comparison also is of importance in connection with safety considerations.

Cost Considerations

Fuel Economy and Other Cost Features

The basic factor involved in comparisons of specific fuel economy of propane and other fuels is the heat or energy content. Propane has a slightly higher Btu content per pound than gasoline and diesel fuel. However, propane weighs only 4.24 lb. per gal. compared to 6.15 lb. per gal. for 60° API gasoline and 7.0 lb. per gal. for 37° API diesel fuel. In terms of gross Btu per gal., the values are shown in the table above.

Higher compression, with its better thermal efficiency, is a necessary means of recovering some of the difference of 27 per cent in energy between a gallon of propane and a gallon of gasoline. The theoretical gain, based on air standard efficiencies, in going from 7:1 to 10:1 compression ratio with gasoline is approximately 10 per cent. However, additional gains in everyday operation can result from the more

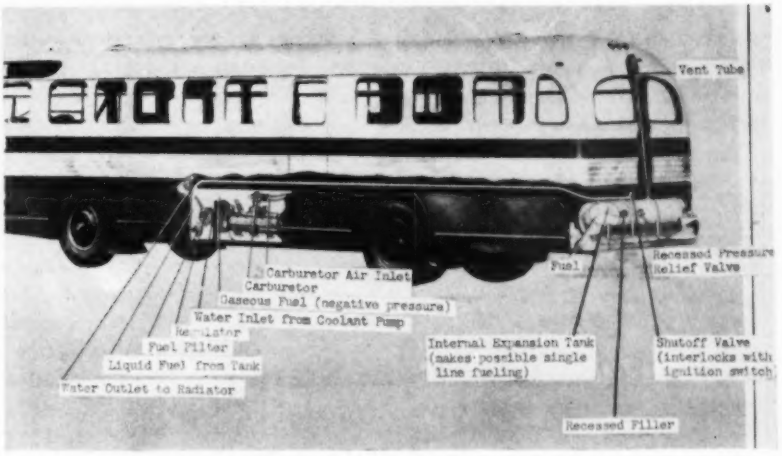
uniform distribution of the propane-air mixture, from the absence of an accelerating pump in the fuel system and from the more complete combustion of propane, particularly during cold operation and warm-up, so that the miles per gal. with propane has been estimated to be within 10 per cent of that of gasoline. Claims for economy equal to or perhaps better than the mileage on gasoline has been made for the Fageol engine operating on propane at 10:1 compression ratio compared to gasoline at 7:1.

Actual mileage experience in the field varies greatly from operation to operation and direct comparisons of propane and gasoline mileage are practically non-existent. In addition, operating experience with LPG-powered coaches is limited at this writing.

Available data is scanty and inconclusive and undoubtedly reflects differences in particular engines and operations, in the efficiency of the carburetion systems used, in the quality of the maintenance, and in the availability of proper test instruments for making correct adjustments. Opinions on LPG consumption compared to gasoline vary as greatly as the figures shown above, but if one wished to hazard an over-all guess of fuel economy, a mileage for LPG ranging from 15 per cent less than to approximately the same as gasoline might be estimated, with perhaps a somewhat greater burden on the new user to maintain the unfamiliar LPG equipment in good order. It should be borne in mind in such comparisons of economy that as gasoline anti-knock quality improves and the compression ratio of gasoline engines increases, the proportionate gain in thermal efficiency with higher compression ratio will be less.

Maintenance Costs

The maintenance comparison, like the fuel economy story, is also uncertain, being rendered more confusing by the greater complexity involved in maintenance operations and analysis, and the lesser accuracy of maintenance costs. The more volatile LPG inherently is a cleaner burning fuel than gasoline, leaving little in the way of residue in the engine and contributing practically nothing to engine deposits. Therefore, engine difficulties associated with fuel deposits would be expected to be very much reduced and longer time between overhauls should be anticipated. In addition to freedom from fuel-formed deposits, dilution of the crankcase oil will be eliminated and reduced wear due to absence of the washing action of gasoline during starting has been claimed. The over-all result is said to be an increase in overhaul time of 50-200 per cent. The elimination of dilution has been reported to allow substantially increased oil drain periods. In addition, the volatile LPG should largely eliminate smoke and odor under conditions of proper engine operation. However, exhaust gas carbon monoxide contents similar to gasoline engines have been reported.



Cutaway view of LPG installation in Twin Coach bus.

Most of these comparisons have been based on LPG engine conversions of lower compression ratios than the new Twin Coach Fageol and ACF-Brill Hall-Scott engines. In the converted lower compression ratio engines not designed for operation on LPG, valve troubles have been reported in a number of conversion cases due to the tendency to run on too lean a mixture. Ring and piston difficulties also have been reported in these older engines. Also, in the case of some of the older engines when the compression ratio was raised from 6:1 on gasoline to 8:1 on LPG, reduced durability of cylinder heads, pistons, connecting rods and head gaskets was encountered with a considerable amount of mechanical failure of these parts. Much better mechanical performance should be expected of the post-war engines designed for high compression ratio operation on LPG. However, the experience on these engines is insufficient at present to properly assess their maintenance record.

As was pointed out earlier, the ignition problems associated with the higher compression pressures would be expected to be more serious as indicated by our own experience with gasoline engines operating at 10 and 12:1 compression ratio. More frequent maintenance and replacement of distributor points and spark plugs might be required. In addition, the higher pressures and temperatures occurring at the higher compression ratios might tend to reduce engine life for the same reasons that reductions in compression ratio from diesel to gasoline engine levels have been claimed to extend engine life. It has been pointed out that in converting engines in use to higher compression ratio LPG engines, they should be put in good mechanical condition with respect to such items as valves, valve seats, guides and bearings.

It is possible also that the LPG conversion unit may require additional attention to assure good operation, since maladjustment may easily lead to over-rich mixtures and poor fuel economy, or over-lean mixtures with the accompanying high temperatures and valve, spark plug and other troubles. In this connection, it might be mentioned that there is a tendency for any oily contaminant in the LPG to accumulate in the regulator system with

danger of interfering with regulator operation and fuel metering, if not removed regularly. Some of the newer regulators and converters have a drain connection at a low point so that oil will be forced through the regulator to the engine; while another has an external trap attached to a low point in the unit. It should be noted that some starting troubles have been observed with LPG due to absence of crankcase oil dilution and a lower viscosity grade of oil than used with gasoline is indicated. Also, carburetor icing may occur in the wintertime if sufficient time is not allowed for the engine jacket water, which heats the vaporizer, to warm up.

Equipment Costs

While conversion equipment for LPG operation varies considerably in price depending on the manufacturer and the completeness of the conversion, the current approximate cost of converting Fageol and ACF-Brill engines has been given as $350-$500. In the case of Fageol this applies specifically to post-war units and includes higher compression ratio engine parts, high pressure tank, converter, carburetor and fittings. In the case of a new engine, the difference in cost between gasoline and LPG equipment is approximately $350.

Fuel Costs

The factor of greatest concern in the cost analysis is the fuel cost. There has been some misunderstanding of relative gasoline and LPG prices which requires clarification. In almost all cases, the pricing system for LPG differs from that of gasoline. The price of gasoline is generally quoted as a tank wagon price on the fuel delivered to the operator, whereas the price of LPG generally is based on tank car F.O.B. the refinery gate. Since the delivery costs for LPG are higher than those for gasoline, the differential in quoted prices for gasoline and LPG must be corrected for the difference in delivery and service cost, which will range roughly from 1 to 2c per gal.

In the Southwest section of the country, LPG is available at 1½ to 4c per gal. in tank car F.O.B. supplier's gate, the current average differential between gasoline and LPG at the refinery being 7c per gal. This is due currently to a very sharp drop in the price of LPG several months ago when the differential in price was 3 to 4c per gal.

The current quotation of propane from refinery sources in the Northeast is below that estimated for LPG transported by tank car from the Southwest, the estimated differential in delivered price to the customer between propane, where available, and gasoline being approximately 3 to 4c per gal. Since propane in many states is taxed as a motor fuel in the same manner as gasoline, including the Federal tax of 1½c per gal., the total differential in price to the operator between gasoline and propane is the difference in delivered prices before taxes.

The stability of any price differential is of major importance to the operator. Thus, one supplier of refinery propane in the Northeast has expressed the opinion that the ultimate differential in price between propane and gasoline in that area will be small and should not be counted on as a principal basis for conversion of automotive equipment. Another major supplier in the East and Midwest, however, has been discussing supplying propane on a long term (3 year) contract basis at more or less fixed differential in price from gasoline, thus differential varying in the different sections of the country. This arrangement will differ with each supplier, some suppliers being unwilling to quote prices on differentials from other products except on a short term basis.

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The availability of LPG varies with each area and each company. Thus, while propane is plentiful in the Southwest, the situation in the case of a number of Eastern refineries is that there is no excess of LPG for automotive use, the supply being committed to the more profitable industrial, utility and bottled gas markets. In some cases, LPG is imported from the Southwest to augment the supply to the Eastern market. It should be mentioned that in most instances, the availability of LPG or propane is largely a matter of price, and recovery and availability of propane by refineries can be increased considerably if the price is sufficient to encourage such action. However, any such increases in price would obviously reduce the differential from gasoline and make the product less attractive to the operator.

The opinion has been expressed that the influx of natural gas to the industrial areas will largely displace LPG. This undoubtedly also varies with each refinery and may be a temporary condition. It is the opinion of at least one company that an appreciable market will exist beyond the gas mains and that large quantities of LPG will be sold to utility companies for standby and peak shaving, as the greater the expansion of natural gas the higher the standby requirements for cold weather emergencies and possible interruptions in the supply of natural gas.

Cost Comparison of Propane vs. Diesel

Almost all of the above discussion and comparison have been between gasoline and propane or LPG. This is justified in comparing the conversion of current gasoline-powered equipment to propane. However, in the case of new equipment, the opinion has been expressed that the competition is between propane and diesel powered

(*Continued on page* 89)

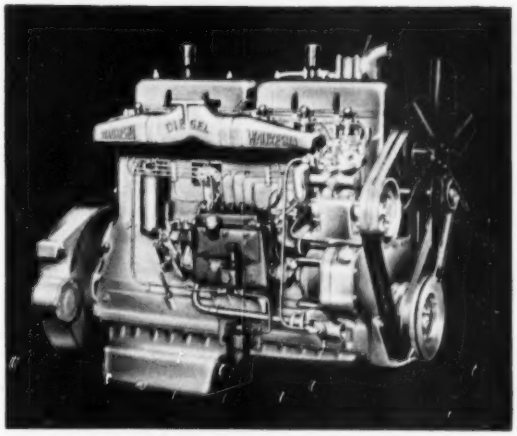
THE PAYLOAD POWER PLANT—

WAUKESHA *Diesel*

● This is a truckers' engine! Most modern in design! And designed for the specific purpose—power for payload! That's fast freight power . . . cross country power . . . cost-cutting power. You get it with this Waukesha High Duty Diesel—Model 148-DK—peak horsepower 200.

Of all its exclusive Diesel design features — the biggest is the patented spherical combustion chamber. It's the *why* of payload power performance—clean burning, lively acceleration, smooth, shock-free operation, high fuel economy with low maintenance.

Other big features — American Bosch injection; hardened and counter-balanced crankshaft with torsional vibration dampner; renewable wet sleeve cylinders; oil-cooled pistons, each with 4 rings, top ring chrome plated; built-in oil cooler. These and all the rest are described and pictured in Bulletin 1532.



148-DK High Duty DIESEL — six cylinder, 5¼-in. bore x 6-in. stroke, 779 cu. in. displacement, peak hp 200.

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New Products

Steam Generator for Diesel Locomotives

A new steam generator, known as the Vapor-Clarkson Model 4740, has been placed on the market by the Vapor Heating Corp. It was developed to supply large quantities of high-pressure dry steam to heat diesel passenger trains, but is now ready for many applications in other industries.

For size and weight it is said to be the most powerful steam generator so far developed. Steam pressure of 200 pounds can be raised within two minutes after starting from 50° F water. In operation 4800 lbs. of 99 per cent dry steam per hour can be produced at an efficiency of 82 per cent. Using No. 2 fuel oil for fuel, the forced draft air and pressure atomized fire releases a million Btu's per cu. ft. of combustion space. The hot gases of combustion pass over 702 ft. of steel tubing, where the water is changed into steam. Circulation through the tubes is maintained by a pump driven by an electric motor (gasoline engine on portable units.) This motor also drives the fuel pump, blower and magneto. Once started, by turning one switch, automatic controls take over causing the machine to turn on or off and produce steam only when needed. Steam pressure can be varied from 75 to 600 psi. by turning one control.

A servo control automatically modulates the unit to produce from one-third to full capacity. No reservoir of water is heated under pressure in this machine, making it impossible to blow-up. Many safety features such as steam temperature limit control, stack temperature cut-out, safety valves, electric flame control, time delay relays have been incorporated into this machine. It is manufactured of the finest materials in accordance with the ASME and Hartford Specifications.

Cool Kit for Locomotives

A complete kit for modernizing the cooling system of diesel electric locomotives not equipped with dynamic braking has been announced by the General Electric Company's Locomotive and Car Equipment Division. The kit includes the new water-type engine oil cooler system, complete with oil cooler supports, oil and water hoses, hose clamps and installation drawing.

The new engine oil cooler has been designed to replace the present air-cooled engine cooling system. According to company engineers, the cooler is reinforced with well-proportioned ribs, furnishes better year-round temperature control, requires less maintenance costs, saves on lube-oil life and brings faster warm-up time for the locomotives using it.

Easy to install, the cooler system can be mounted on the floor of the air chamber in front of the engine's water radiator. A simple piping arrangement connects the new oil cooler into the engine's cooling system. The new cooler does not require moving parts.

Miniature Variable-Speed Drive

Speed ratio is easily controlled, it is claimed, in the new Metron Instrument Company miniature variable-ratio speed-changer, known as the 4C, by the employment of a simple push rod.

Through the application of an extended push rod, levers, cams, or virtually any properly applied linkage, a wide variety of control techniques is possible. Extension of the push rod makes remote lever control possible, and remote ratio indication, on a scale of any size, is obtained by means of a scale associated with the remote actuating speed adjuster.

Small, compact, and completely sealed, this drive has ratings up to 72 oz.-in. torque, 0.025 hp., 20,000 rpm. and the ratio is infinitely variable from 1/6 to 6.0

Applications include timers, recorders, controllers, computers, indicating mechanisms, and similar low power devices requiring remote or automatic control.

New Bonney Tools

Tough sheet metal, including stainless steel and duraluminum, is now easily sheared with Bonney's new metal snips. Three models are available—for right hand cutting, for left hand cutting, or special universal model for right or left cuts.

The snips feature a special compound leverage design which gives maximum cutting power with a minimum of effort, it is claimed. The drop-forged chrome-vanadium steel jaws are serrated to provide a sure grip on the work. The spring-actuated jaws are 2½ in. long, handle 6¾ in., and the overall length 9¾ in.

Also introduced is a complete line of power sockets. The precision broached sockets are available in regular length with double square sockets for ½ in. drive. To meet the "all-purpose" requirements where bolts run longer than the normal length of the nut, single hexagon, bolt clearance length power sockets are available in ½ in. and ¾ in. square drives. The sockets are made from selected alloy and especially heat treated to withstand rugged use.

Proto Wrenches Improved

All Proto standard box wrenches, open end wrenches and combination box and open end wrenches were redesigned recently to improve their efficiency, appearance and ease of handling.

Jaws of open end heads were made narrower to reduce the overall width of the new pear-shaped heads and thus permit work in closer quarters. In redesigning the jaws, they were scientifically tapered to provide extra strength at points of greatest strain.

Edges of the shanks were well rounded to make the shanks easier on the hands, to speed work and to enhance appearance.

Open end flats and box exteriors are now polished with a high luster and shanks are given a satin finish. After a detailed study, most lengths were changed to provide the proper leverage for each wrench and to make the progression of lengths more uniform.

New Impact Wrench

A new, heavy duty universal electric tool for tough nut running jobs in truck, bus, and industrial maintenance fields has been announced by Ingersoll-Rand Company. Known as the size 34U "impactool," it has a 1 in. square driver, and is rated for bolts up to 1¼ in. size.

The 34U employs a heavy duty, universal electric motor and a proven I-R impact unit, placed side by side to reduce overall height, which permits handling truck U-bolt nuts without jacking up the truck. The impact mechanism automatically converts the power of the electric motor to hundreds of rotary impacts whenever sufficient resistance to turning is met.

★ ★ ★

BRIGGS OIL CLARIFIERS ON STATIONARY-TRANSPORT-MARINE DIESELS PAY OFF BIG..

...BECAUSE THEY KEEP LUBE OIL CLEAN—PHYSICALLY AND CHEMICALLY!

100% BRIGGS IS PROOF!

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Model D-8-BR-SV4
One of seven Briggs Oil Clarifiers at Transcontinental in Ellicott City

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CRANKSHAFTS · CONNECTING RODS
MACHINE FORGINGS
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These rotary impacts quickly run nuts up tight, or remove rusted or frozen nuts. Due to the design of the mechanism, no kick or twist is transmitted to the operator. The 34U is reversed by a switch, located for convenient operation.

The precision made ball and cam impact mechanism minimizes friction and is said to insure long trouble-free operation. The major working parts, the hammer and anvil are made of special heat treated alloy steel. The large striking faces assure maximum surface life. A renewable bushing in the front of the tool provides bearing surface for the alloy steel anvil or socket driver.

New Foam for Petroleum Fires

A liquid type mechanical foam for use on fires involving polar solvents or petroleum products has been introduced by the National Foam System, Inc.

Known as Aer-O-Foam "99", it is claimed to be easily generated in a mechanical system, freely flowing to provide a smothering, close-knit blanket of fire killing foam.

The new extinguisher is non-corrosive, and free flowing at temperatures as low as 10° F. If frozen, it retains its effectiveness upon thawing out.

Portable Fire Extinguisher

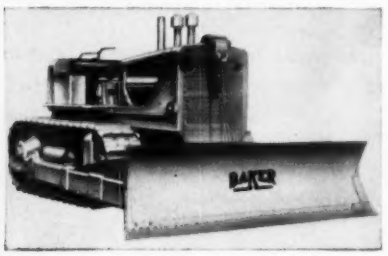
A 4-lb. dry chemical fire extinguisher with a rubber hose is now on the market, introduced by Ansul Chemical

Co. It is said to offer these advantages: (1) ease of operation; (2) flexibility in fighting overhead and ground-level fires; (3) maximum extinguishing effectiveness for inexperienced operators.

Operating range of the extinguisher is 12 to 15 ft. It has received a B2, C2 rating from Underwriters' Laboratories. Dry chemical is ejected through a self-closing nozzle which produces the fan-shaped stream pattern. It has a capactiy of 4 lb. of dry chemical, and when fully charged weighs 10½ lbs. Each unit is subjected to 600 psi. hydrostatic test.

New Cable-Control Mountings

Redesign of cable-control mountings for the new and larger line of



bulldozers, gradebuilders and root rippers developed to match the new and more powerful Allis-Chalmers crawler tractors, is announced by The Baker Manufacturing Company of Springfield, Illinois.

The new cable models are for the A-C HD-9, HD-15 and HD-20 tractors. Baker is the only manufacturer producing a cable unit for the HD-9. This company also recently brought out a larger line of engine-mounted, hydraulic control dozers, gradebuilders and root rippers for the full A-C crawler line, including the smaller HD-5.

Redesign of the cable-control mounting provides maximum visibility, streamlined appearance, easy interchangeability, improved protection for cables and radiator and new push beam power tilt.

The low frame cable mounting provides streamlined appearance with greatest visibility, it is claimed. The cable is located under the fender, close to the side of the tractor, well protected from brush and limbs. The built-in radiator guard with perforated grill, is an integral part of the cable frame.

Quick, easy interchangeability be-

tween dozer, gradebuilder and root ripper is provided by removal of a bolt on each side, removal of wedges and detachment of the lower sheave block at the front.

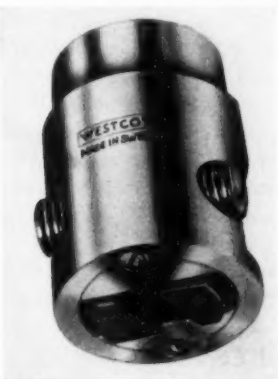
The new power tilt eliminates the need for jacks or pry bars to raise or lower the push beam. Reverse tilt of the moldboard also is accomplished by power, rather than manual effort.

The "roll action" design of all Baker blades, which leaves more of the tractor power for push and maneuvering, is retained in all models.

Two-Jaw Drill Chuck

The Westcott Chuck Company is now offering to the metal working industries a 2-jawed drill chuck which is being made for them in Sweden. The design is the same as the former "little giant" 2-jaw drill chuck, "Oneida" model, the manufacture of which was discontinued several years ago.

The chuck is available in three sizes, as follows: No. 119-3, capacity 0 to ½ in., 0 to ¾ in., and 0 to 1 in. Morse taper arbors for the chucks are available, also replacement parts.

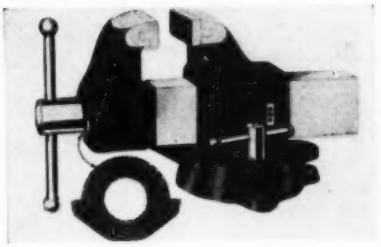


The chucks are simple in design and construction, easy to operate, accurate, and compact. The upper part of the chuck housing is reinforced with a steel collar. A T handled operating wrench is supplied with each chuck.

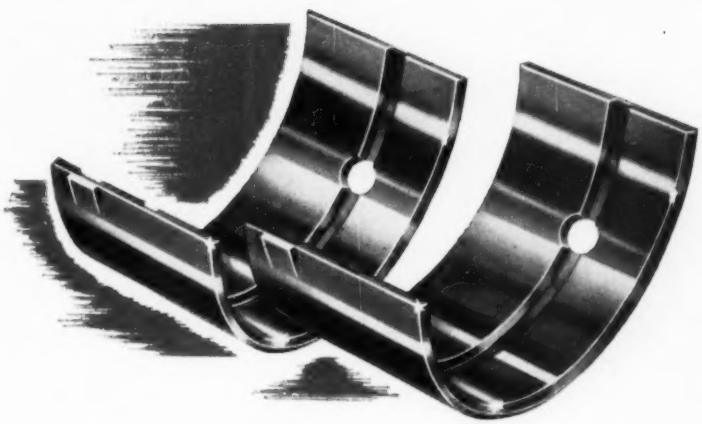
New Machinists Vises

An improved line of malleable iron machinists' vises is announced by The Columbian Vise & Mfg. Company.

One feature is use of a new type graphite-bronze, self-lubricating thrust bearing located at the front of the sliding jaw, to absorb the thrust of the steel screw head. The manufacturer states that, because of this bearing, the vises can be pulled up tighter and held more securely with less pressure than ordinarily required.



The machinists' vises are made in



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TODAY'S Diesel power plants in marine, vehicle and stationary use are the finest engines of their type ever built.

Master designers and makers of these fine engines specify and use only top quality components, including CGB bearings of the proper type and construction.

Should bearing replacement become necessary, master engine mechanics maintain the high standard of engine performance with Monmouth Bearings. These bearings are identical in every detail with the original bearings. They excel all others in finish, in precision, in quality and in engineered performance.

In the maintenance of Diesel engines—whether marine, stationary, or in prime movers—specify genuine Monmouth Engineered Bearings.

Monmouth Bearings are engineered and precision made to safeguard the reputation of the master Diesel engine mechanics and to insure user safety and satisfaction.

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FIG. 1280A #4L

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all standard sizes— 3 to 8 in. jaw widths. Their "sledge-tested" malleable iron castings are guaranteed unbreakable. Hardened tool steel jaw faces of "T" section design are pinned into the castings so they cannot come loose in use, but can be easily replaced if chipped or worn.

New Literature

Oil Purification Booklet

A new 16-page booklet, entitled "The Facts About Clean Oil" has been prepared by the Honon-Crane Corporation. It contains information on oil purification for hydraulic equipment, metal-working machines, gas and diesel engines, turbines, transformers, etc. It shows the correct method and equipment to stop downtime, cut down rejects, improve and increase plant production.

Thread Insert Bulletin

A 16-page, 2-color bulletin, covering design data on helical-wire thread inserts and their use in protection and repair of tapped holes is offered by the Heli-Coil Corporation. Also covered are the uses of these screw thread inserts in production salvage and maintenance operations.

Nine pages of tabular data give basic insert lengths, recommended drill sizes, roughing and finishing-tap specifications, and thread gages to be used with various types and sizes of thread inserts.

Hand and power tools for all levels of production are also described.

Speed Control Booklet

The Electric Machinery Manufacturing Company recently released a booklet which discusses "Precision Speed Control with the Adjustable-Speed Magnetic Drive".

This 32-page book is technical in scope, and contains complete information both on the magnetic drive and the new magnetic amplifier regutron speed control. The technical information is clarified through the use of charts, diagrams, and illustrations. A fully illustrated section is also included which covers the application of the instruments in industry.

Petroleum Facts and Figures

The Ninth Edition of Petroleum Facts and Figures, published by the American Petroleum Institute is now available. The book contains 491 pages of tables and every effort has been made to provide complete and accurate information on the industry. It is intended to serve as a reference for oil men, students, educators, journalists, and all others who have an interest in the petroleum industry.

The cost of the volume is $2.50.

Oil Cooler Catalog

Young Radiator Company has announced the publication of its catalog on unit oil coolers. These units are used for oil cooling where cooling water is scarce and/or the waste heat can be utilized to warm room interiors. It is a non-ferrous tube-and-fin type cooler, and is available in nine physical sizes. Catalog gives design features, physical dimension data, etc.

Bibliography of Technical Reports

Volume 14 of the "Bibliography of Technical Reports" (July-December, 1950) is now indexed according to subject. The bibliography, issued monthly, lists additions to the 150,000 document Office of Technical Services collection of foreign and domestic reports. The new index is the 11th to be issued.

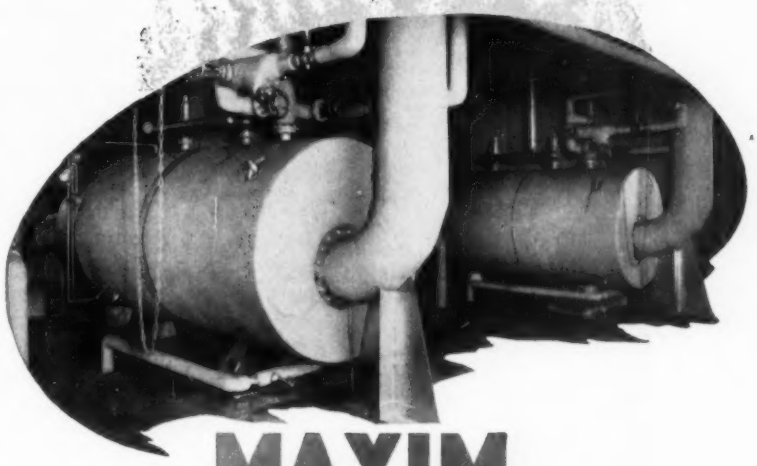
Copies of the "Subject Index to Volume 14" may be purchased from the Office of Technical Services of the U. S. Department of Commerce, Washington 25, D. C., at $1.00 per copy.

Alcoa Booklet

Aluminum Company of America has prepared a 14-page illustrated booklet on its East St. Louis Research Laboratory, serving Aluminum Ore Company, a wholly-owned subsidiary of Alcoa devoted to the manufacture of industrial chemicals, principally the aluminas and fluorides.

Besides describing the laboratory building and its equipment, the booklet tells the aim and scope of the research and the nature of the products that Aluminum Ore Company provides.

IS WASTE HEAT WASTING YOUR MONEY?



MAXIM

HEAT RECOVERY SILENCERS CONVERT WASTE EXHAUST HEAT TO USABLE STEAM or HOT WATER

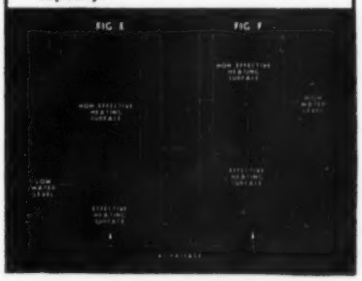
A big Los Angeles Sewage Disposal Plant found that Maxim Heat Recovery Silencers provided all the steam necessary for plant heating as well as heating the sludge — *and from exhaust heat that would otherwise have been wasted.*

Perhaps your own operating expense picture can be improved by this simple and effective way to provide extra steam or hot water for heating or processing operations while at the same time effectively silencing exhaust noise. Our engineering department will be glad to make recommendations.

Automatic Controls

In figure E water is low and there is less *effective heating surface* (heating surface in contact with water), hence lower steaming rate.

In figure F water is high and gives greater effective heating surface — higher steaming rate. Steam pressure regulated valves control the amount of water to produce desired steam capacity.



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REPRESENTATION IN PRINCIPAL CITIES

Cleaning Folder

Oakite Products, Inc. has released a folder discussing their steam-detergent cleaning. It lists specific tasks in industry for which the process is applicable, and also supplies detailed specification of the types of steam-cleaning equipment available, and offers data on the preparation of working solutions for use with this equipment.

Lubrication Booklet

The Climax Molybdenum Company has issued a booklet entitled "Molybdenum Disulfide as a Lubricant".

It consists of various excerpts from technical papers dealing with the subject. Most of the papers were published by the National Advisory Committee for Aeronautics. All the excerpts are fully illustrated by charts, diagrams and photographs.

Taylor Forge Catalog

Taylor Forge & Pipe Works has issued a new catalog, describing and illustrating their forge nozzles, welding necks and large diameter flanges. Also included are data concerning standards of the Tubular Equipment Manufacturers Association. The company publication, "Modern Flange Design", is also incorporated as a part of the catalog.

Synthetic Oil Studies

The development of synthetic lubricant oils by Germany's I. G. Farben is reviewed in a new report now available from the Office of Technical Services of the U. S. Department of Commerce.

The report, prepared by the Defense Department's Central Air Documents Office, is a description of studies in this field carried on by I. G. Farben's Division of High Pressure Experiments, beginning as early as 1924, and culminating in the developments made during World War II.

Included in the report are a description of the chlorine method of lubricant-oil synthesis, giving the per cent yields of various oils; a discussion of the paraflow synthesis and its application to lubricant oils with solidification points of from -10° to -30° C; and a review of the synthesis of lubricant oils from propylene by polymerization with $AlCl_3$. The properties of propylene oils are given, as well as the results of engine tests.

Vibration Fatigue Tester Booklet

All American Tool and Manufacturing Company has released a 6-page folder which describes a number of vibration fatigue testers.

These testers are said to pretest any part or assembly, thereby knowing beforehand whether inherent weaknesses in the design or materials exist.

Detroit Diesel Catalog

A new loose-leaf master parts catalog has recently been completed by Detroit Diesel Engine Division of General Motors. For release exclusively to authorized distributors and dealers, it covers the entire range of series 71 diesel engines from the 2-cyl. through the 24-cyl. "quads" and including all optional accessory equipment.

A loose leaf binder will be provided for the catalog, and new and revised pages will be issued monthly. An indexing method is used based on model number and type of the engine. The basic key information is carried on a stamped metal plate attached permanently to the engine as well as on the distributors' delivery record cards.

Service Tools Bulletin

A manual, "Special Service Tools for Quick Service Operations", has recently been published by Kent-Moore Organization, Inc. It describes and illustrates selected special service tools which are of interest to dealer service departments, auto repair shops, service stations and fleet maintenance departments.

Among the tools described are: powerglide-dynaflow oil changing tool set, containing 4 tools for changing of oil in automatic transmissions; multi-purpose reverse flush gun kit, for flushing cooling systems, pressure degreasing, pressure car washing and air cleaning; cooling system leak detector, which locates restrictions, leaks and other cooling system defects; brake bleeder and filler, a portable self-con-

tained unit which operates without compressed air; precision torque wrenches, with range of 0 to 25, 50, 150 and 200 ft. lbs.

I-H Tractor Folder

Fleet application of their TD-24 diesel crawler tractors are presented pictorially in an 8-page folder recently published by the International Harvester Company. In addition to the fleet scenes in the earth moving, mining, pipelining and lumbering fields, the folder also contains a brief listing of the mechanical features of the 148 drawbar horsepower crawler.

G-E Buyers' Guide

A profusely illustrated, 93-page brochure, supplying pertinent buying information on instrument transformers, has been announced as available by the General Electric Company's Meter and Instrument Divisions.

The publication is divided into sections which offer technical data on indoor and outdoor potential transformers, current transformers, metering outfits, potential and current portable transformers. Listings of ratio and phase-angle tests, coupled with tables covering the mechanical and thermal limits of current transformers, round out the balance of the brochure.

Surge Control Bulletin

Through proper design and use of snubbers, such costly innovations as special piping or specially reinforced pipeline structures in compressor installations become unnecessary, according to a bulletin on "Surge Control in Gas and Air Piping", issued by the Burgess-Manning Company.

This bulletin states that installations can be designed that will be free from surging and the resultant vibration of gas pumps. It also contends that metering fluid flow will be greatly simplified in a properly designed system.

It is explained that surging due to the pulsating flow of compressible fluids in pipelines is not an accoustical problem, but one of dynamics. The application of snubbers provides surge control which permits operation of plant and equipment at rated design conditions.

JOHNSON BEARINGS 1901-1951

FIFTY YEARS OF PROGRESS IN SLEEVE BEARINGS

By sharing in the fifty-year development of automotive and industrial America, Johnson Bronze has become a leading manufacturer of Sleeve Type Bearings. Great changes have been made in Johnson Bearings in that time. New types and designs have been developed. New conceptions of bearing materials and refinement of alloys were important steps of progress. Metals have been combined for greater serviceability, lighter weight and lower cost to the user. Many of the Johnson Sleeve Bearings of today show only superficial resemblance to the types of fifty years ago.

Leading manufacturers in all fields find this vast experience and "know-how" accumulated since 1901 to be very helpful. Perhaps we can be of assistance to you in determining the correct bearing for each application . . . and in producing your requirements exactly to specifications. Why not write—TODAY?

Johnson Bronze

470 SOUTH MILL STREET • NEW CASTLE, PA.

Field Notes

Oil and Gas Power Division, ASME, Officials Honored

Dallas, Texas, was the scene of a highly successful Conference and Exhibit of the Oil and Gas Power Division, ASME. In true Teaxs style, things were done in a big way. Honorary citizenship of the State of Texas was conferred by gubernatorial signature on three officials of the Division. Prof. C. J. Echardt, Vice-President, Region VIII, ASME, (right) presented the certificates, along with other mementoes of the occasion, to (next right to left) Division Chairman T. M. Robie, Fairbanks, Morse; Treasurer E. J. Kates, consulting engineer; and Secretary B. P. Emerson, Diesel Power and Diesel Transportation.

A big technical program included seven papers presented at four Technical Sessions, two Panel Discussions dealing with operation and maintenance of internal combusion engines; an interesting meeting of the General Technical Committee; and the special OGP Lectures Series, this time concerned with the subject of "governing". It was the general consensus that the information presented, when published in the "Proceedings", would add considerably to engineering literature.

Even the inspection trip was big. Two DC-3 planes were chartered for a flight across a good portion of Texas to Corpus Christi for a visit to the diesel powered Halliburton Cement Company plant. Next stop was Victoria, Texas, for inspection of the largest internal combustion plant in the world, Alcoa's Point Comfort aluminum ore reduction plant.

GM Truck Preventive Maintenance

A new preventive maintenance program has been designed by General Motors Corporation Truck & Coach Division to help truck operators to gain greater economy and efficiency. The system was originated after a two-year nationwide survey of company service and retail personnel and dealer service managers. Factory instructors are explaining it to company field service personnel in a series of 25 meetings across the country, and service experts are presenting it to the dealers.

Whereas the previous system had five different services to cover all operations, the new program has an "A" service for gasoline-powered vehicles that have been driven either three to six weeks or 1000 to 3000 miles, and a "B" service for trucks driven either three to six months or from 10,000 to 20,000 miles. For diesel trucks, the two services are placed in effect after somewhat longer periods of operation.

I-H to Subcontract

International Harvester will subcontract between 80 and 90 per cent of the material it requires for present prime government contracts, it was announced recently. The dollar value of the contracts is approximately $355,000,000.

For example, 327 subcontractors will participate in a contract for armored utility vehicles. These 327 subcontractors have, in turn, made arrangements with 1377 subcontractors of their own, so there is actually a total of 1704 other businesses known to be involved. Analysis shows that almost half are "small business" (employing 500 or less).

Alloy Casting Research

Significant expansion of its technical research program is being undertaken by Alloy Casting Institute. In addition to extension of continuing research activities, three new projects are being instituted.

First, alloy conservation studies are being conducted at Batelle Memorial Institute on the high temperature properties of the 21 per cent chromium, 10 per cent nickel type alloy. Secondly, development of titanium-stabilized corrosion resistant castings, important for use in aircraft production, is being investigated at Ohio State University. Lastly, a study of improved gating systems for high alloy casting production will be conducted as part of the ACI program under auspices of the Shop Practice Committee of ACI.

ABOE Policy Change

Major changes in operating policy, involving a conversion to defense work and suspension of commercial diesel engine sales, were announced recently by ABOE, Inc., American branch of the Brush-Aboe Group of Associated Companies, London.

Although it had been hoped to operate the new defense program while continuing commercial diesel sales effort, it has been found impossible to do so because of growing consumer production difficulties and price control.

Lamme Medal Awarded

Ralph L. Boyer, vice president and chief engineer of The Cooper-Bessemer Corporation, has been awarded the Ohio State University Lamme Medal for the development of the gas-diesel engine and the high compression spark-ignited gas engine.

The annual conferring of this medal for meritorious achievement in engineering is a result of an endowment to the university by Benjamin G. Lamme, former chief engineer of the Westinghouse Corporation. Mr. Boyer is the 24th graduate so honored from over 10,000 Ohio State engineering graduates since 1892.

Minneapolis-Honeywell Courses

On September 17 the Brown Division of the Minneapolis-Honeywell Regulator Company will start the first semester of its 1951-52 courses in industrial instrument maintenance and repair. This course, conducted annually for more than a decade at the Brown School of Instrumentation at Philadelphia, will continue to December. That and the second semester, starting in January, will include a 13-weeks comprehensive course concurrently with the shorter classes. These courses will be for the benefit of customer and Brown personnel.

Instruction in the yearly classes is being made available to enlisted and officer personnel of the military, and for members of various government defense agencies. In addition, special instruction is being provided for students from friendly foreign countries.

Cummins Dealers

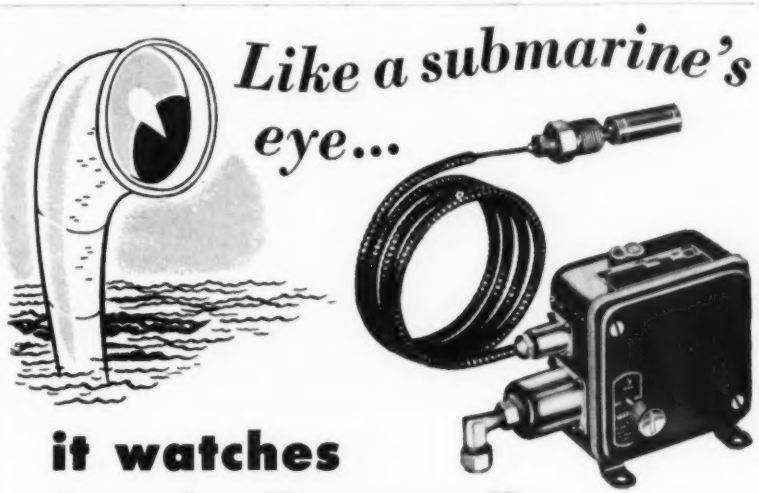
Cummins & Moran, Cummins dealers for Arizona, New Mexico, the three most Western counties of Texas, and two Southeastern counties of Nevada, have occupied a new 12,500 sq. ft. building in Phoenix, Arizona.

The shop has equipment for repair and maintenance of diesels, including an engine and chassis dynanometer for complete engine overhaul, rebuilding and testing. A complete stock of parts is also available.

New Fairbanks, Morse Plant

Construction of a new plant near Kansas City, Mo., for Fairbanks, Morse & Co. was started recently. Originally planned as a scale plant, it has been enlarged to approximately 500,000 sq. ft. of floor space, which includes a foundry, and is to be used to make engines and pumps.

The new plant will be a one story structure and is to be constructed of brick and reinforced concrete. The cost is placed at $7,500,000.



Like a submarine's eye...

it watches for the "enemy"

Your engines have two damage-creating enemies! One is low oil pressure and the other is overheated jacket cooling water. But, both *can be detected and stopped* by the PENN Safety Control before they can cause damage and costly repairs.

Here's how it's done. If water temperature rises to the danger point . . . or if oil pressure drops . . . the PENN control goes into action immediately! It *automatically* sounds an alarm, flashes a warning light or stops the engine operation . . . whichever you choose. Then the fault can be investigated and corrected *before* damage occurs.

Learn more about this *low-cost protection* for new or old engines. Send for your free copy of Bulletin E-100 which fully describes the three basic models for . . . oil pressure . . . water temperature . . . combination pressure and temperature. Write **Penn Electric Switch Co., Goshen, Indiana.** Export Div.: 13 E. 40th Street, New York 16, N. Y., U.S.A. In Canada: Penn Controls Limited, Toronto, Ontario.

PENN

AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

GREATER CARE means LONGER WEAR

Protect Your

VIKING PUMPS

Father Time is kind to Viking Pumps because they're built sturdy and simple, having only two moving parts. However, you'll enjoy even longer and more dependable pumping service from your Vikings when you give them *extra* care.

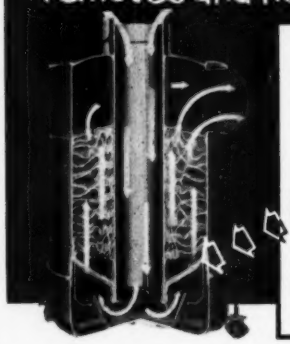
For information and instructions on correct installation, operation and maintenance of your Viking Pumps, write today for your *free* copy of the Viking Service Manual D.

VIKING AN HONORED NAME IN PUMPING

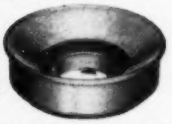
See Our Catalog in SWEETS

Viking PUMP COMPANY Cedar Falls, Iowa

New Tray-Type AIR CLEANER removes and holds more dirt!



RECOMMENDED FOR HIGH-CAPACITY ENGINES on large tractors, rock crushers, power shovels, etc. Large dirt-holding capacity allows longer interval between servicing.



REMOVABLE TRAY SIMPLIFIES SERVICING. Entire tray is quickly removed for cleaning. Multiple screens prevent clogging of condensing element.

IN THIS NEW Donaldson heavy-duty cleaner, the removable multi-screen "tray" and revised oil cup design feeds more of the condensed oil back into the air stream adjacent to the center tube.

A balanced distribution of oil across the entire lower element has been achieved, eliminating both overloaded and "thin" areas.

Extensive tests in the field over a period of five years prove conclusively that the new cleaner has a higher efficiency and a greater dirt-holding capacity. We invite manufacturers to write or call for design data and test reports.

DONALDSON CO., INC. 666 Pelham Blvd., St. Paul 4, Minnesota Donaldson Co. Ltd. (Can.), Chatham, Ont.

Donaldson AIR CLEANERS

Correction, Please

Last month's issue presented an article entitled "Selection and Casting of Babbitts". It contained some errors that should be called to the attention of our readers so as to enhance the value of the article.

"Nickel" appears twice in place of "silver", once in the third paragraph of the "Introduction" and again near the bottom of the first column on page 46. In the same column the formula for the tin base babbitt should read: 85-10-5.

Three lines of type were left out of the first complete paragraph on the center column on page 45. It should read ". . . material with a thermal expansion coefficient comparatively close to that of the lining. Tin base babbitt has an expansion ration figure of 22 to 24, whereas the bronze . . . "

Our apologies to both the readers and to the author.

Mack Diesel Railcar

The New Haven Railroad has requested Mack Trucks, Inc. to build a single-unit, light-weight diesel railcar. The specifications and design of the car have been drawn up in close cooperation by the engineering departments of both organizations. Actual work is being done at Mack's Allentown, Pa. plant.

The powerplant of the new unit consists of a 220-hp., 6-cyl., supercharged diesel engine, coupled directly to a 300-volt dc. generator. The propulsion equipment consists of four 55-hp. electric motors, with two mounted on each rail truck. Each motor drives a set of wheels through a propellor shaft and axle gearing. The car accommodates 45 passengers.

Weld Test

A simple, low-cost method for conducting structural model tests of welds in heavy steel plate has been developed by metallurgists at the Naval Research Laboratory, ONR. The method features the bulging of welded plate by means of an air blast set up by the detonation of an explosive. Application of the explosion-bulge test to the study of weld deformations has provided basic information needed for a comprehensive approach to the fracture problems.

Heli-Coil in Japan

The Heli-Coil Corporation recently announced the departure of Eugene M. Lang, vice-president in charge of manufacturing, to Japan to complete licensing arrangements to give the Tsugami Manufacturing Company, Ltd., of Tokyo, sole right to manufacture and distribute Heli-Coil thread inserts in the Far East.

Mr. Lang will guide this Japanese manufacturer of precision machine tools and measuring machines in the setting up of tooling, manufacturing, gaging and inspection operations and will help in the selection and training of personnel.

New Fram Plant

The Fram Corporation has announced the opening of its new oil filter and replacement cartridge plant in Greenville, Ohio.

Greenville was selected because of its strategic location in relation to the company's midwestern distributors, as well as the major automotive manufacturing centers in Michigan and Ohio. The city and its surroundings has an adequate labor supply, and the corporation expects to employ over 400 people.

Gasoline-from-Coal Plant in South Africa

Construction of the world's first modern, commercial, gasoline-from-coal synthesis plant will start in South Africa within the near future.

The plant, costing £18,000,000, largest industrial project to be undertaken in South Africa since the last war, is being engineered and built for SASOL—South African Coal, Oil and Gas Corporation, Ltd. It will be located adjacent to the Vaal River, near the town of Coalbrook in the Orange Free State, about forty miles south of Johannesburg, and will produce 60,000,000 gal. of fuel per year.

The project is an integrated plant which embraces the opening of virgin coal deposits to supply raw material; the construction of above-ground gasification facilities to transform coal into synthesis gas; and the complete synthesis plant, to produce liquid hydrocarbons. The plant is primarily designed to produce liquid fuels—gasoline and diesel oil—in volume. The M. W. Kellogg Company of New Jersey and New York will act as overall project managers, and their new "synthol" process will be used.

Cummins to Purchase from Europe

For the second time in seven months, Cummins Engine Company, Inc., recently sent representatives to Europe to purchase steel and aluminum needed to maintain current high levels of production. Two representatives will visit Belgium, Germany, Luxemburg, Norway and England to inspect steel and aluminum making facilities and place orders for various types of high quality steel and aluminum.

The company explained that European material is being sought because domestic sources indicated that they will not be able to supply all of the expected requirements. Quality of European steel used to date has been satisfactory and delivery promises have been kept.

New Heli-Coil Plant

The Heli-Coil Corporation has moved from its plant in Long Island City, N. Y. to a new plant at Danbury, Connecticut.

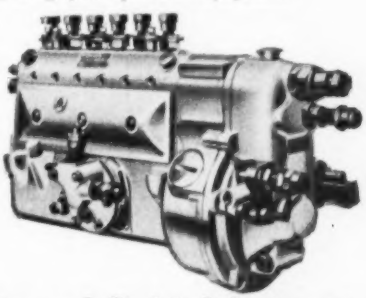
In addition to the manufacturing area, laid out to take advantage of straight-line production methods, the new one-story brick, concrete-block and steel structure will also house the firm's executive, administrative and sales offices and its engineering and product development departments. Ten acres of land are provided for future expansion.

Confidence Abroad

Transport operators all over the world have learnt to trust this sign.

In any language the letters on the C.A.V. sign stand for first-rate service facilities, maintained by highly-trained craftsmen, using special precision equipment.

Wherever vehicles fitted with C.A.V. Fuel Injection Equipment are exported — whether to Trondheim, Santiago, Hong-Kong or Sydney—there's a service agent or depot to give it the specialist attention needed for such high-precision equipment.



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Fuel Injection and Electrical Equipment

Service Depots throughout the World

C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC., NEW YORK 19, N.Y. Sales Office: 14820 DETROIT AVE., CLEVELAND 7, OHIO

174-344B

Baldwin-Lima-Hamilton Contract

For power supply in the largest municipal electric plant in the United States, at Freeport, Long Island, Baldwin-Lima-Hamilton Corporation has been awarded a contract for a diesel engine of 4350 net brake horsepower. The engine will drive a General Electric generator of 3100 kw. capacity. Installation will be during 1952.

The engine is a Model 921-SA, 9-cyl., with 21½ in. bore and 27½ in. stroke, running at 257 rpm. It is a 2-cycle, port scavenged, with rotary exhaust valves and motor driven centrifugal scavenging blower.

Lubricant Test

A method for determining the effectiveness of lubricants at pressures previously impossible to measure with scientific accuracy in ultra-thin films has been developed in the laboratories of the Socony-Vacuum Oil Company, Inc. at Paulsboro, N. J.

A new testing instrument can exert measurable pressures up to 250,000 psi. between two metal bearing surfaces. It consists of a vertical and horizontal steel cylinder, each ¼ in. in diameter, oriented at a right angle to the other. The horizontal one is maintained in a fixed position while the vertical one is capable of being rotated under pressure or for exertion of direct pressures up to 250,000 psi.

Gauges connected with the instrument provide readings on the force of drive, extent of loading at the oil-filmed contact point, and the amount of torque present when the instrument is in operation. Effectiveness of lubricants is measured after each operation by microscopic examination of wear on the cylinders at their contact point or the depth of a pit created in the fixed cylinder after the upright cylinder has been rotated against it.

National Supply Canadian Office

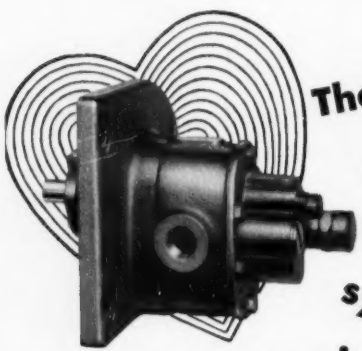
The National Supply Company, Ltd. has established a department in Calgary to handle the sales accounting functions of the company in Canada. The operations had previously been conducted from Pittsburgh, where the company's principal accounting offices are located.

The expansion program in the Canadian office operations calls for doubling of office space, due to growth of the oil industry throughout Alberta and a desire to facilitate Canadian customer transaction. It also carries out the company's policy of concentrating all business operations within the country affected. The expanded facilities will include divisional sales headquarters, credit office, and accounting office.

Metals Carbides Sales Office

The Metal Carbides Corporation, Youngstown, Ohio, announced the opening of a new sales office, warehouse and service plant in Detroit.

Located in a new concrete block building, 20 by 60 ft., a complete stock of standard products will be carried. Mr. A. B. Christman will be in charge.



The HEART of a diesel lubricating system is its PUMP

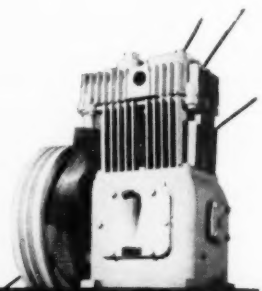
Rotary geared pump with special flange mounting becomes integral part of diesel engine when installed. Note opening above relief valve for tachometer.

Modern diesel operation generally requires a pressure lubricating system — and the vital element is the pump. Thousands of Brown & Sharpe pumps are now providing reliable service month after month without interruption, for lubrication, transfer, or booster systems. Available with various types of flange mountings and special internal construction to meet specific requirements. Write for catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

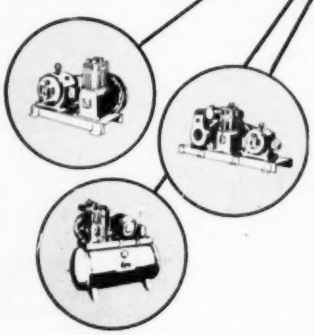
We urge buying through the Distributor

BROWN & SHARPE

MODERN COMPACT Quincy COMPRESSORS



For Dependable COMPRESSED AIR SUPPLY



Quincy Compressors are not only compact, but they are always dependable. Specially designed for greater durability, Quincy Compressors features include — Timken Bearings — Lynite rods — perfectly balanced crankshaft — copperfinned intercooler — automatic and positive lubrication. Quincy Compressors are available in a wide variety of sizes ranging from 1 to 90 c. f. m. Depend on a Quincy specialist to help you select the correct type and size compressor to meet your requirements. Write Dept. J-19 today for details and latest prices.

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QUINCY, ILLINOIS
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WHY WORRY about REPLACEMENTS?

ALL CYLINDERS AND CRANKSHAFTS ARE ALWAYS RENEWABLE WITH VANDERLOY M AND PORUS-KROME

For Less Cost than Replacement!

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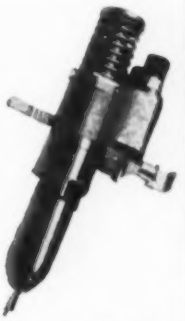
Good for the Life of your Engines

Attention: Maintenance Superintendents and Owners of Diesel-Powered Equipment

HANCOCK

RECONDITIONED UNIT INJECTORS FOR GM 71 AND 567 ENGINES ARE AVAILABLE FROM OUR STOCK ON AN EXCHANGE BASIS, AS ARE GM 71 FUEL TRANSFER PUMPS.



HANCOCK Service Gives You:

- One day delivery from our stock.
- The service of a modern injector laboratory completely tooled with the latest grinding, lapping and gaging equipment to handle all necessary work.
- A flat price for injector exchange regardless of condition of the plunger and bushing.
- A completely rebuilt unit injector that has been thoroughly tested after an actual run-in test.
- Any output of 71 engine injector available — 60 mm, 70 mm, 80 mm and 90 mm.
- An unconditional guarantee of satisfaction.

We will buy used General Motors and Caterpillar injection equipment.

Dealers write for our attractive proposition

DIESEL SERVICE DIVISION

HANCOCK MACHINE COMPANY, INC.

300 WALNUT STREET — FINDLAY, OHIO

Machine Tool Unit Formed by NPA

The National Production Authority is creating a special unit to help builders of tools to get the materials and facilities they need to increase production.

Charles E. Wilson, Director of Defense Mobilization, issued a directive that every assistance be given to machine tool builders. He sought to assist the industry in raising its output from the present $675,000,000 annual rate to at least two billion by 1953. The increase was needed to assure essential metal working machinery for the defense production effort.

Within two days of Mr. Wilson's directive, the Office of Price Stabilization announced it was liberalizing the price control regulations applying to machine tools so that builders would have greater incentive to step up their production. NPA has established the Metal Working Equipment Division within the Industrial and Agricultural Equipment Bureau. The new division will handle Controlled Materials Plan paper for the metal working machinery industry and will be responsible for the proposed expansion program in the industry.

Students Visit Naval Engineering Experiment Station

Maryland Diesel School students, numbering approximately 35, accompanied by Mr. Basil W. Dennis, president of the school, spent a morning recently at the U. S. Naval Engineering Experiment Station, Annapolis, Md.

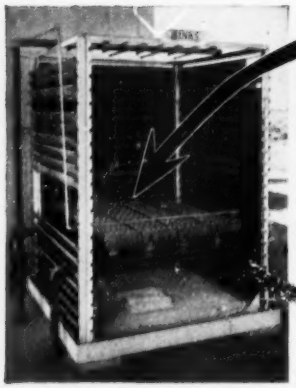
Pictured are some students being shown by L. T. Kelley, of the Engineering Experiment Station, the panel which controls the General Motors 16-278A diesel engine in the station's internal combustion engine laboratory.

Steam Generator Cars

The Texas and Pacific Railway recently designed and placed in service its first fully automatic steam generator car, said to be an innovation in the diesel rail transportation field.

The thought behind the construction of this car was to provide a flexible and mobile source of steam supply to meet the variable and unusual periods of weather in Texas, both for heating passenger and troop trains, and for emergency and standby power plant requirements over the entire system.

The cars not only generate steam, but produce their own compressed air for atomizing purposes, generate electric current for operation of motors on steam generators and for trainlining to various cars for lighting purposes as well as having sufficient additional capacity to operate a me-



Binks closed-type
DIESEL COOLING SYSTEMS

A Binks natural draft cooling tower with louvers removed to show Binks closed-type evaporative heat exchange coils.

Increased and more uniform heat transfer

Binks Type "D" evaporative heat exchange coils assure Diesel operators uniform...economical engine performance. Two-way cooling by "evaporation" and "convection" plus higher velocity of hot jacket water inside coils gives increased heat transfer. Scale formation in engine jacket is prevented since jacket water never mixes with raw cooling water. Breakdowns are reduced; insurance cut.

Send for Bulletin 41. Obtain full information—drawings, tables—on heat exchange coils adaptable to a variety of operating conditions.

Binks MANUFACTURING COMPANY
3114-38 Carroll Ave., Chicago 12, Ill.
REPRESENTATIVES IN ALL PRINCIPAL CITIES

BACHARACH NOZZLE TESTER for LARGE SIZE DIESEL NOZZLES

Check These Features

- Test Pump 1800 cu/mm capacity; ported design. Leak-proof—plunger is chrome steel, hardened, ground and lapped into pump body.
- Nozzle-holding Fixture has spring clamps that accommodate nozzles of different shank diameters. Nozzle is simply "snapped" into position between the clamps.
- Fuel Supply Reservoir (2.5 pint capacity) of durable, transparent plastic; fuel level can be easily observed.
- Micronic-type Filter is noted for its superior cleaning efficiency; is easily replaceable.

Get full particulars — Write for Leaflet 628

BACHARACH
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7000 BENNETT STREET • PITTSBURGH 8, PA.

chanical air conditioning system on an adjoining car, or provide lighting in case of light failure on trains in which this car may be operating.

The car can also be used as a stationary power plant at remote stations where heating and electric facilities are not available.

Aid for Oil Search

The basic magnetic properties of certain types of underground formations will be used soon in a new way to aid the petroleum industry in its unremitting search for new supplies of crude oil.

Successful development of an underground magnetic measurement device by the Field Research Laboratories, of Magnolia Petroleum Company, Dallas, an affiliate of the Socony-Vacuum Oil Company, Inc., recently was announced.

The new method is potentially useful in the sub-surface mapping of the topography of geological formations which might contain oil at places where the layers have formed traps and permitted oil to accumulate. It has potential value also in providing oil geophysicists and geologists with geological information that hitherto has been unavailable.

Organizational News

Worthington Vice President

A. H. Borchardt has been elected a vice president of Worthington Pump and Machinery Corporation, and will have overall responsibility for the sale of the corporation's entire line of pumping equipment.

Mr Borchardt was graduated from Columbia University, and then joined the company's erecting and testing department. He became successively draftsman, field engineer and sales engineer. In 1921 he was made assistant manager of the Centrifugal Pump Sales Department, becoming its manager in 1929. He then became successively sales manager of the Harrison plant, manager of the Commercial Engineering Department, and in 1934, assistant vice president and manager of centrifugal pump application and sales division.

Falk Managers

Rodger J. Mueller has been appointed manager of the Falk Corporation's Youngstown, Ohio office. He will serve customers in Ohio, Pennsylvania, and West Virginia. F. J. Bower, who has represented the company for many years in the Youngstown area, will remain in an advisory and consulting capacity.

Mr. Mueller has been associated with the corporation for 14 years, and was in the Pittsburgh office for four years.

D. B. Bodholdt succeeds Mueller in the Pittsburgh office.

Truck Mileage Tax Bureau Appointments

Gerald E. Rowley has been named director of the Truck Mileage Tax Bureau, which will adminster the New York State's new tax on heavy trucks.

The assistant director of the bureau is Emory E. Towson, formerly assistant secretary to the State Workman's Compensation Board.

Allis-Chalmers Changes

Leonard J. Linde has been appointed assistant general manager and chief engineer of the Boston Works of Allis-Chalmers Manufacturing Company. Before his appointment, he was retained by contract as consulting engineer for the Boston Works. Previously, he was chief engineer for the A. B. Chance Company. He has been responsible for many developments, particularly in oilless power circuit breakers. He holds many patents in the switchgear and allied fields.

Other changes are: Henry P. Pinkham, assistant chief engineer; John F. Chipman, product engineer; George W. O'Keeffe, manager of sales; Alfred E. Kilgour, assistant manager of sales; Russell J. Neagle, special representative; and Chester D. Ainsworth, standards engineer.

New Cummins President

Robert E. Huthsteiner was elected president of Cummins Engine Company. Formerly executive vice president, he succeeds J. Irwin Miller, who becomes chairman of the board.

Mr. Huthsteiner has been associated with the company for almost ten years, having come to Columbus from Chicago in 1942 to be sales manager. He was named controller in 1944 and elected a vice president in 1946. He was elected a director for the first time in 1947 and also served successively as treasurer, general manager, and then executive vice president for the last two years.

A member of the present munitions board industry advisory committee for internal combustion engines, Mr. Huthsteiner also served on a similar advisory committee during World War II. His industry activities include active participation in the Internal Combustion Engine Institute, which he served as an officer during 1949 and 1950.

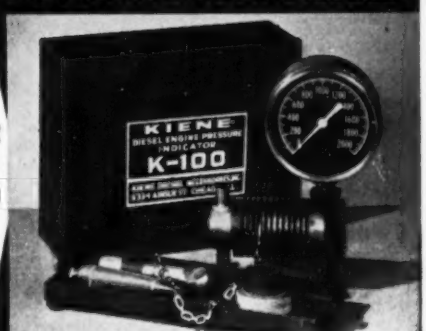
American Brake Shoe Appointment

Bernard G. Drummond was appointed assistant director of exports for American Brake Shoe Company.

An electrical engineering graduate of Heriot-Watt College in Edinburgh, Scotland, Mr. Drummond was the company's regional manager for South Africa from 1948 until his recent transfer to New York headquarters.

SAVE MONEY BY *KNOWING* WHEN TO OVERHAUL YOUR DIESELS

KIENE DIESEL INDICATOR will tell you Compression and Firing Pressures ...FAST



WHY GAMBLE?

With the KIENE DIESEL PRESSURE INDICATOR, you waste no money on costly overhauls done too soon—take no risk of putting off overhauls until too late.

The KIENE INDICATOR tells, reliably by accurate measurement of compression and firing pressures, when your engine needs attention.

SIMPLE—no complicated adjustments. **RELIABLE**—not affected by heat. **ACCURATE**—effects of friction and inertia eliminated. **RUGGED**—only one moving part. **COMPACT**—weighs less than ten pounds.

LOW IN COST—For full details, send for Bulletin K-100.

KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

Specify

COLUMBIA

A. C. and D. C. GENERATORS

- For Coupled Service
- For Belt Drive
- Single or Two Bearing

Columbia, with its years of experience, brings to generator set assemblers a wide line of performance proved, sturdily built, A. C. and D. C. Generators.

AC Generators: 6¼ to 1000 KVA
DC Generators and Exciters: 2 to 300 KW

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Write for information. Our Engineers will be glad to review your requirements.

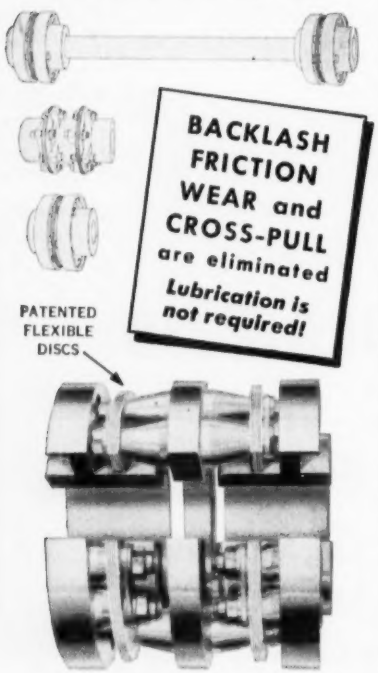
COLUMBIA ELECTRIC MFG. CO.
4537 Hamilton Ave. Cleveland 14, Ohio

THOMAS
Flexible ALL METAL
COUPLINGS
FOR POWER TRANSMISSION
REQUIRE NO MAINTENANCE

Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
½ to 40,000 HP
1 to 30,000 RPM

Specialists on Couplings for more than 30 years



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.
NO MAINTENANCE PROBLEMS.
ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

"Cat" Changes

Leonard J. Fletcher, former director of training and community relations, has been elected a vice president of Caterpillar Tractor Company. He joined the firm in 1927 as director of agricultural sales, was named assistant general sales manager in 1937 and has been director of training since 1941.

Ralph J. Morgan has been promoted from assistant to the president to executive assistant, Clyde L. Shewyhart from assistant director of training to the new education and training department, and Fred R. Jolly from assistant director of community relations to manager of the community relations department.

Baldwin Directors

At a recent annual meeting of shareholders of Baldwin-Lima-Hamilton Corporation the following directors were elected for the coming year:

Charles E. Brinley, Henry B. Bryans, A. A. Byerlein, H. E. Coombe, Joseph N. Ewing, George U. Harris, Edward Hopkinson, Jr., McClure Kelley, William Clarke Mason, L. E. Osborne, Frederic A. Potts, Jerome Prestin, Gwilym A. Price, William Wood Prince, G. A. Rentschler, Walter A. Rentschler, A. W. Robertson, J. J. Rowe, Robert C. Shields, James M. Skinner, Marvin W. Smith, Ralph K. Stiles and Harold E. Talbott.

National Supply Appointments

John Seagren has recently been appointed chief engineer of the National Supply Company's Engine Division at Springfield, Ohio. A native of Sweden, he joined Fairbanks, Morse Company in the United States in 1925. He joined National Supply last July when the engine division assets of Atlas Imperial Diesel Engine Company, for whom he was chief engineer, was purchased.

Harvey W. Hanners has been appointed chief research engineer. He has worked for the company since 1941, and has been assistant to the chief engineer and chief engineer.

Mr. Noltein is the new consulting engineer. He has been with the company since 1927 and has served as chief engineer and director of research.

Enterprise Sales Head

Enterprise Engine & Machinery Company has appointed Dale W. Blanton to direct export engine sales in San Francisco.

Mr. Blanton was engaged in a similar capacity while with Atlas Imperial Diesel Engine Company from 1940 to 1950, with the exception of four years of service with the Navy.

G-E Public Relations Chief

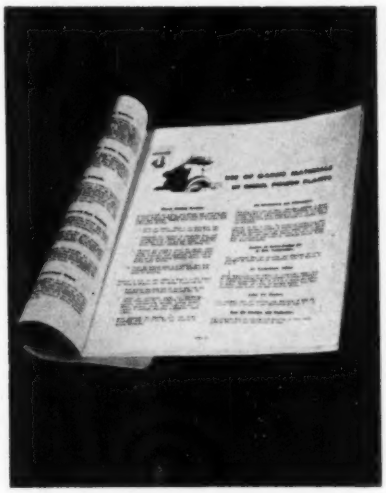
Chester H. Lang, vice president of the General Electric Company since 1941, has been appointed to a new post in charge of public relations.

A graduate of the University of Michigan, Mr. Lang served the company as assistant manager of the Publicity Department at Schenectady, advertising manager, manager of the Publicity Department, manager of broadcasting, and manager of sales, Apparatus Department.

Cooper-Bessemer Promotes

The Cooper-Bessemer Corporation's office of chief engineer has added T. O. Kuivinen, R. F. Kymer and W. R. Crooks as chief engineer's assistants.

Under the new engineering management plan, technical matters will be handled by Mr. Kuivinen. Liaison or coordination of activities between engineering and production will be directed by Mr. Kymer, who will also take Mr. Crooks' place as resident engineer at the Grove City plant. Mr. Crooks will assist in a general administrative capacity as well as direct his efforts in research and development projects. He has done much work with the supercharging of spark ignited gas engines.



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Mack Appointment

R. W. Allen has been appointed district manager of Mack Motor Truck Corporation's St. Louis Branch.

Mr. Allen, who joined the corporation in 1926 as payroll clerk in its Detroit office, subsequently became a salesman in that territory, later became sales manager in the Twin Cities branch and for the last ten years has been manager of the Houston branch.

Electro Motive Promotions

To implement a new program of expanded sales and service, Electro-Motive Division of General Motors has made the following promotions:

C. L. Moss, formerly sales representative, Washington, D. C., is now district sales manager, New York. James B. Swindell has been promoted from sales representative, Chicago, to Chicago district sales manager. Warren A. Thomas, formerly manager of statistics and market analysis section in the sales department is now sales manager, LaGrange factory branch. Charles F. Lincoln, Jr., formerly manager of the product application section of the sales department, has been promoted to assistant general parts manager. Kenneth J. Wolf succeeds Mr. Lincoln as manager of the product amplification section.

Buda Elects

At a recent meeting of the board of directors of The Buda Company L. F. Shoemaker was elected vice president.

Mr. Shoemaker first became associated with the company 31 years ago. His long career has included positions in service, new engine field test, retail sales and manufacturers sales departments. He has served many years as regional representative and in distributor and branch retail sales. For the last 12 years, he has been in the executive sales capacity as manager of

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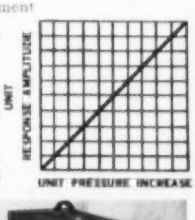

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industrial engine sales division and then as engine sales manager.

Minneapolis-Honeywell Manager

Charles W. Bowden, Jr. has been named chemical industry manager for the Brown Instruments Division of Minneapolis-Honeywell Regulator Company.

Bowden will specialize on ordnance and defense projects related to the chemical industry. He will continue in a consulting capacity in the central stations and power field.

Trumbull Sales Manager

Douglas J. Donohue has been appointed Atlantic District sales manager for Trumbull Electric Department of General Electric Company, Plainville, Connecticut. He will maintain his office in Philadelphia.

Mr. Donohue joined Trumbull in 1930 in the Pacific Northwest Region. He became head of that region's engineering activities in 1940, and since 1945 has been a salesman for its Eastern territory.

National Supply Controller

Martin H. Miller has been named Division Controller for The National Supply Company's Engine Division. He will coordinate all accounting functions of the division.

Mr. Miller joined the company in 1934 as a mail boy. He held, successively, the positions of cost clerk, chief cost clerk, budget supervisor, and plant controller at the Springfield plant.

Johns-Manville Appointment

A. K. Higbee has been appointed production manager of the Johns-Manville Building Products Division and a vice president of the company's Products Corporation. He is a manager of the building products plant in Waukegan, Illinois, and in his new post will supervise the production of building products at plants in Manville, N. J.; Jarratt, Va.; Natches, Miss.; Marrero, La.; Alexandria, Ind.; Waukegan, Ill.; and Los Angeles, Watson and Pittsburg; Calif.

Mr. Higbee joined the corporation in 1928 as a planning engineer at the Waukegan plant, and in 1935 was transferred to New York as a methods engineer. He returned to Waukegan in 1937 as superintendent of asbestos shingles and asphalt roofing and paper, and was made building products manager of this plant in 1946.

New Honeywell Engineers

A 40 per cent increase has been made in the engineering staff at Brown Instruments Division of Minneapolis-Honeywell Regulator. Because of shortages of engineering manpower, 30 colleges, universities and technical schools were combed and 103 additional engineers have been hired.

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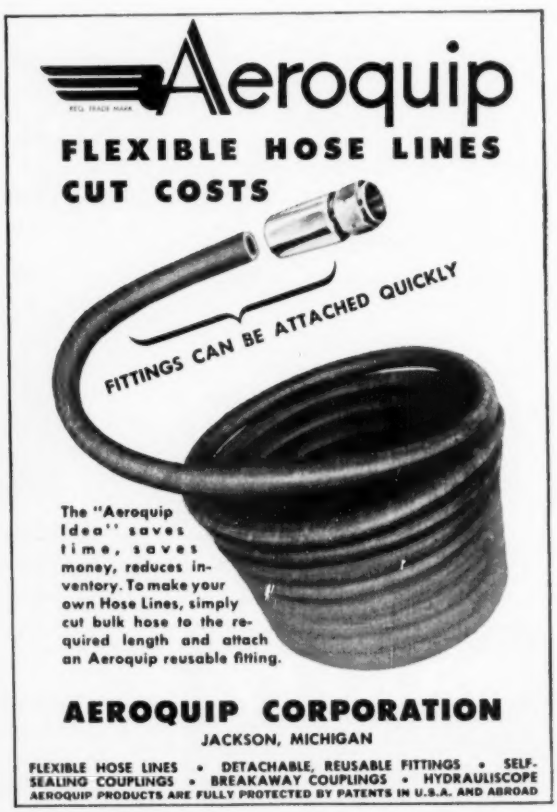
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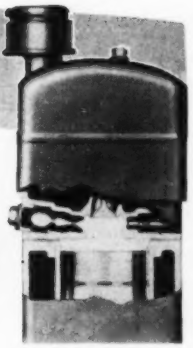

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A large percentage of the new men include graduates of last December and June. Each new engineer is being given an intensive training course in Philadelphia.

Marion Vice President

John P. Courtright has been elected as executive vice president of The Marion Power Shovel Company at a recent meeting of the board of directors.

For several years Courtright served as the company's vice president in charge of sales and service and continues in this capacity in his new position. He has been associated with the company since 1927, first working out of the Chicago sales office where he was later made district manager.

Alloy Casting Institute President

Warden F. Wilson, general sales manager, Lebanon Steel Foundry, has been elected president of the Alloy Casting Institute.

Mr. Wilson, who served as a director of the institute prior to his election, has been active in the institution of intensive research and product development undertakings of the industry.

Other officers elected are: H. T. Harrison, Duraloy Co., as vice president; Mr. Schoefer, re-elected secretary and treasurer.

Cooper Bessemer Promotions

Thomas E. Eagan has been promoted to a new position of research

metallurgist of The Cooper-Bessemer Corporation. He will direct research in the field of nodular iron and other engineering metals for production needs.

A national director of the American Foundrymen's Society, Mr. Eagan is also a member of the American Society for Metals, the British Iron and Steel Institute and the American Society of Corrosion Engineers. He is chairman of the subcommittee of specifications for nodular iron of the American Society for Testing Materials and is on the Iron and Steel Committee of the Society of Automotive Engineers. He is also a member of the American Institute of Mining and Metallurgical Engineers.

W. R. McCracken will replace Mr. Eagan as supervisor of the foundry research laboratories in Grove City, Pa. He will also supervise materials control of foundry operations in both the Mount Vernon, Ohio and Grove City, Pa. plants.

Flexible Tubing Engineers

There are two new additions to the staff of Flexible Tubing Corporation.

Leo Martin is the new machine design engineer in charge of machine development and design laboratory.

He was formerly with the New Haven Clock Company.

James W. Hull is the new chief of the chemical laboratory and development section. He will also direct the setting up of quality controls in the new production lines. He has worked formerly as manager of Kelly Rubber Company's Massillon, Ohio property.

De Laval Executives

James P. Steward has been elected president of the De Laval Steam Turbine Company. He formerly was executive vice president.

Wencel A. Neumann, Jr., is the new vice president of industrial sales and will be responsible for industrial and commercial sales.

H. G. Bauer has been elected vice president of engineering and will also continue as manager of marine sales. He was previously vice president and executive engineer.

Charles A. Jurgensen has been elected vice president of manufacturing and will continue to serve as works manager.

Perfect Circle Vice President

At a recent meeting of the board of directors of Perfect Circle Corporation W. B. Prosser was elected vice president. He is also chairman of the board of directors of the Canadian subsidiary.

Prosser first joined the organization in 1925 as a salesman for the General Piston Ring Company in Tipton, Indiana. In 1928 that company was joined with Perfect Circle and then became the Tipton plant. Prosser later became plant manager and then sales manager for the firm. In 1943 he became general factory manager of the Richmond plant, and later general manager.

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Worthington Manager

Herman H. Miller, left, manager of the Compressor Division of Worthington Pump and Machinery Corporation in Buffalo, has relinquished the managership of his division to act as consultant to his successor, E. A. Murray.

Mr. Miller, who has been with the company 50 years, plans to retire at the end of this year.

Mr. Murray, right, was graduated from Yale University in 1926. In 1935 he joined the company's Compressor Division, and in 1940 was made an electrical consulting engineer, and in 1948 assistant manager of the division.

Borg-Warner Appointments

Robert D. Turner has been appointed secretary-treasurer of the Marvel-Schebler Products Division of Borg-Warner Corp. at Decatur, Ill. He has been assistant to the treasurer of the corporation's Pesco Products Division at Bedford, Ohio. In his new post he succeeds Walter E. Walpole, resigned.

Socony Egyptian Appointment

Brandon H. Grove, formerly of the producing department, has been named general manager of Socony-Vacuum Oil Company, Inc. operations in Egypt and the Red Sea to succeed Robert S. Stewart, retired.

After starting with the company in 1935, Mr. Grove spent the next four years in the European offices. He returned to the United States in 1940 for a training period with Magnolia Petroleum Company, Socony affiliate, and then went to Spain and Colombia. He was on loan to the Foreign Eco-

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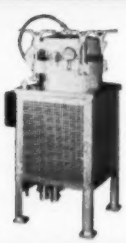

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nomic Administration from 1943 to 1946, and was in Europe for Socony from 1946 to 1949, when he returned to New York. He was transferred to the Cairo office in 1950.

American Chain and Cable Appoints

Vincent Lysaght has been appointed sales manager of the Helicoid Gage Division of American Chain & Cable Company, Inc. He formerly directed the sales of the Campbell Machine Division and Wilson Mechanical Instrument Division.

A graduate of M. I. T. in 1924, Mr. Lysaght became laboratory technician with the Wilson Mechanical Instrument Company. He was transferred to the sales department, becoming sales manager in 1935.

LPG Versus Diesels

(*Continued from page 66*)

coaches essentially, rather than between propane and gasoline powered vehicles. In such comparison, the better fuel economy of the diesel plays an important role.

In the 135 hp. range, the difference in price between the gasoline and diesel powered coaches of one manufacturer is approximately $1000, while while the differential in the 200 hp. range is about $1600. The latter figure compares with the value of approximately $600 per vehicle for conversion, storage, dispensing and ventilating equipment for propane operation, assuming a one-year pay out. The diesel engine is generally considered to show an improvement in fuel economy over gasoline of 33½ to 50 per cent. In addition, diesel fuel is not subject to the Federal tax of 1½c per gal., and its price at the refinery is generally less than that of gasoline. On the debit side, diesel engine initial cost and probably maintenance are higher on the average than for the gasoline engine. While no comparison of over-all costs of propane and diesel powered coaches will be attempted here, one operation showed a considerably lower fuel cost in terms of seat miles ($5.23 per 10,000 seat miles) over LPG ($9.09 per 10,000 seat miles), the latter having a lesser advantage over gasoline ($10.78 per 10,000 seat miles). Again, such comparisons probably vary for each operation and circumstance.

In conclusion, it can be said that no fundamental technical difficulties appear to exist in the automotive use of LPG. Engines of higher compression ratio, now available, compensate for the lower heat content of LPG, fuel consumption in mpg. equivalent to gasoline being possible.

Also, although reduced maintenance is an item, economics of LPG vs. gasoline or diesel powered coaches is keyed chiefly to the differential in fuel cost. Stability of the price differential is a major factor in projecting costs of LPG operation compared to the other fuels, particularly in the East where the differential is less than in other sections of the country.

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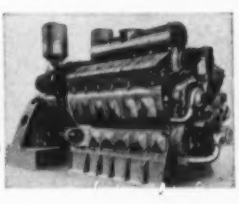

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Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

Expansion Joint of the Month

GENERAL DESIGNS

Zallea Stainless Steel Flexible Connectors are available in two general designs. Figure 15, which has a small corrugation, is made in sizes 4″ to 10″ inclusive. Figure 8 has a much larger corrugation, similar to that used in Zallea Non-Equalizing Expansion Joints, and is made in sizes up to 72″ diameter.

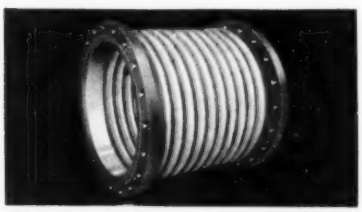

Figure 8

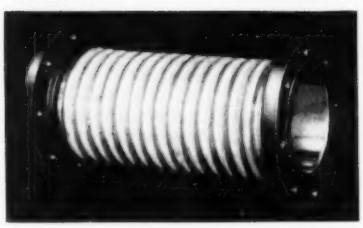

Figure 15

Figure 8 Flexible Connectors are designed to absorb $\frac{1}{4}$″ axial movement (5″ diameter and smaller $\frac{3}{16}$″) per corrugation up to a maximum of $\frac{1}{2}$″ traverse with open pitch corrugations and up to a maximum of 3″ traverse with close pitch corrugations. Figure 15 Flexible Connectors are designed to absorb .083″ axial movement per corrugation up to a maximum of $\frac{1}{2}$″ traverse with open pitch corrugations and up to a maximum of 2″ traverse with close pitch corrugations.

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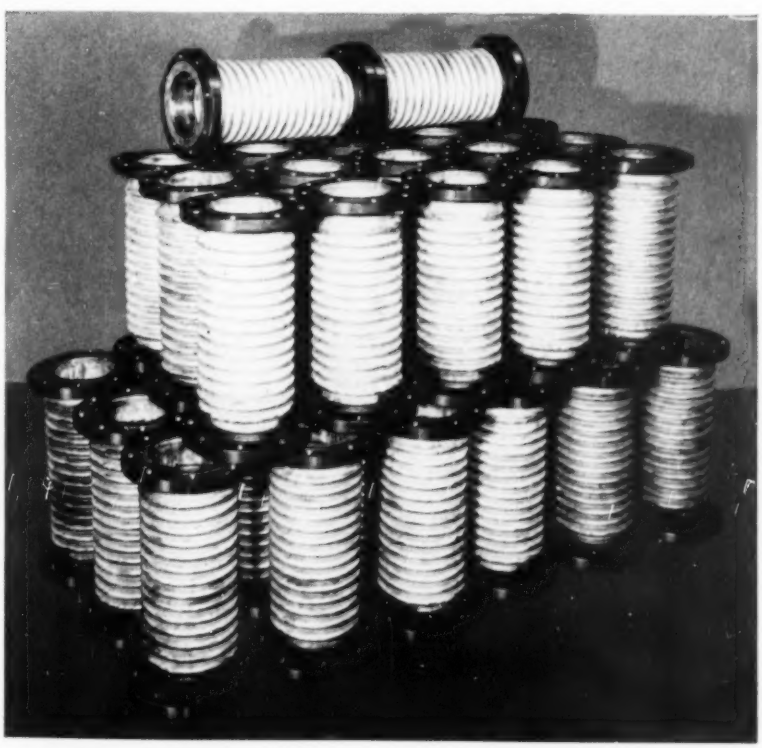
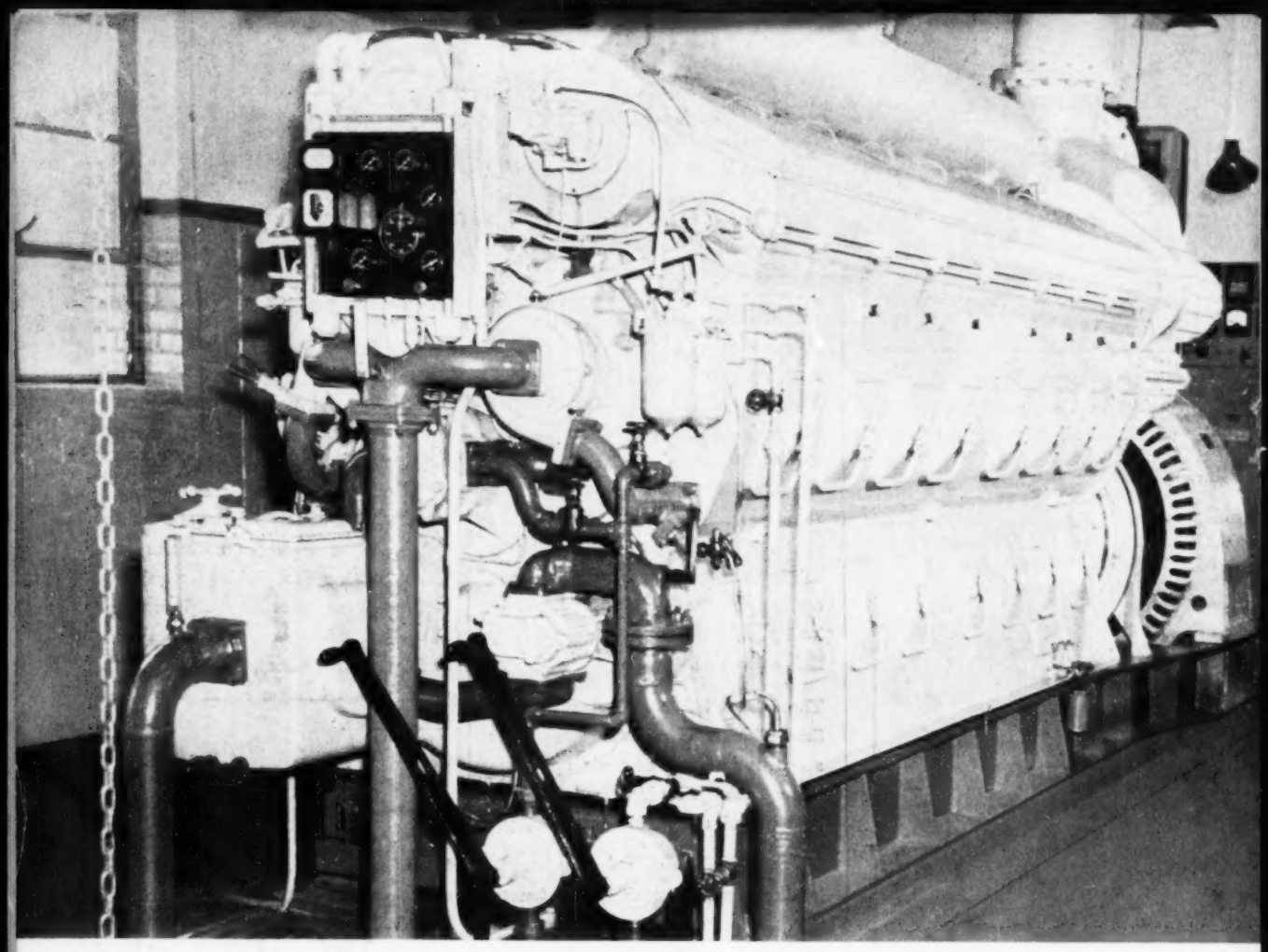
The group of Zallea 6″ diameter Figure 15 Stainless Steel Diesel Exhaust Flexible Connectors, pictured below, is part of a recent shipment of *several hundred* units to a classified government project. The choice of Zallea Flexible Connectors for this important project is another vote of confidence to the dependability and long-lasting performance of these top-quality Zallea products.

Throughout industry, Zallea Stainless Steel Flexible Connectors provide the answer to a widespread need for inexpensive expansion joints capable of absorbing both lateral and axial movement, yet having extreme flexibility.

Made expressly for use on Diesel exhausts, high temperature air and gas lines, and like applications, these expansion joints have a uniform wall thickness resulting from hydraulic forming which insures maximum durability and long trouble-free life. Made of a single sheet of welded stainless steel, there are no seams or joints to open and no packing is required—they are permanently gas-tight under all conditions. Because of their great axial and lateral movement, bends may be made to a minimum radius of twice the diameter.

Zallea Stainless Steel Flexible Connectors are available in diameters from 3″ to 72″ and in any practical length, with flanged or welding ends or a combination of both to handle exhaust temperatures up to 1600° F.





Big lift for loaded diesels...

●To meet rapidly increasing power demands, a midwest power company installed four new 1440-hp diesel engines in 1948, one of which is shown above.

Steps were taken to insure uninterrupted service from these vitally needed engines. A Standard Oil lubrication specialist was consulted. Upon his recommendation, STANDARD HD Oil was given the important job of lubricating the diesels.

Despite the fact that engines have operated continuously from 6,000 to 7,000 hours with up to 110% rated load, there has been no lubrication difficulty. No maintenance, other than a valve grinding job, has been required. Engines have operated at top efficiency.

STANDARD HD Oil, a truly heavy-duty lubricant with effective detergent qualities and high oxidation resistance, will reduce maintenance and boost the reliability of your diesel engines.

STANDARD HD
TRADE MARK
OIL

A Standard Oil lubrication specialist is ready to help you gain maximum benefits from STANDARD HD. This man is located near your plant and will give you "on-the-spot" service. Arrange today for his visit by contacting the nearest Standard Oil office or by writing to:

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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